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May 6, 1944

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Gremlins!

Suggested by F.Lt. D. A. Tibbenham

My Goodness — My GUINNESS

G.E.1164

THE ILLUSTRATED
LONDON NEWS

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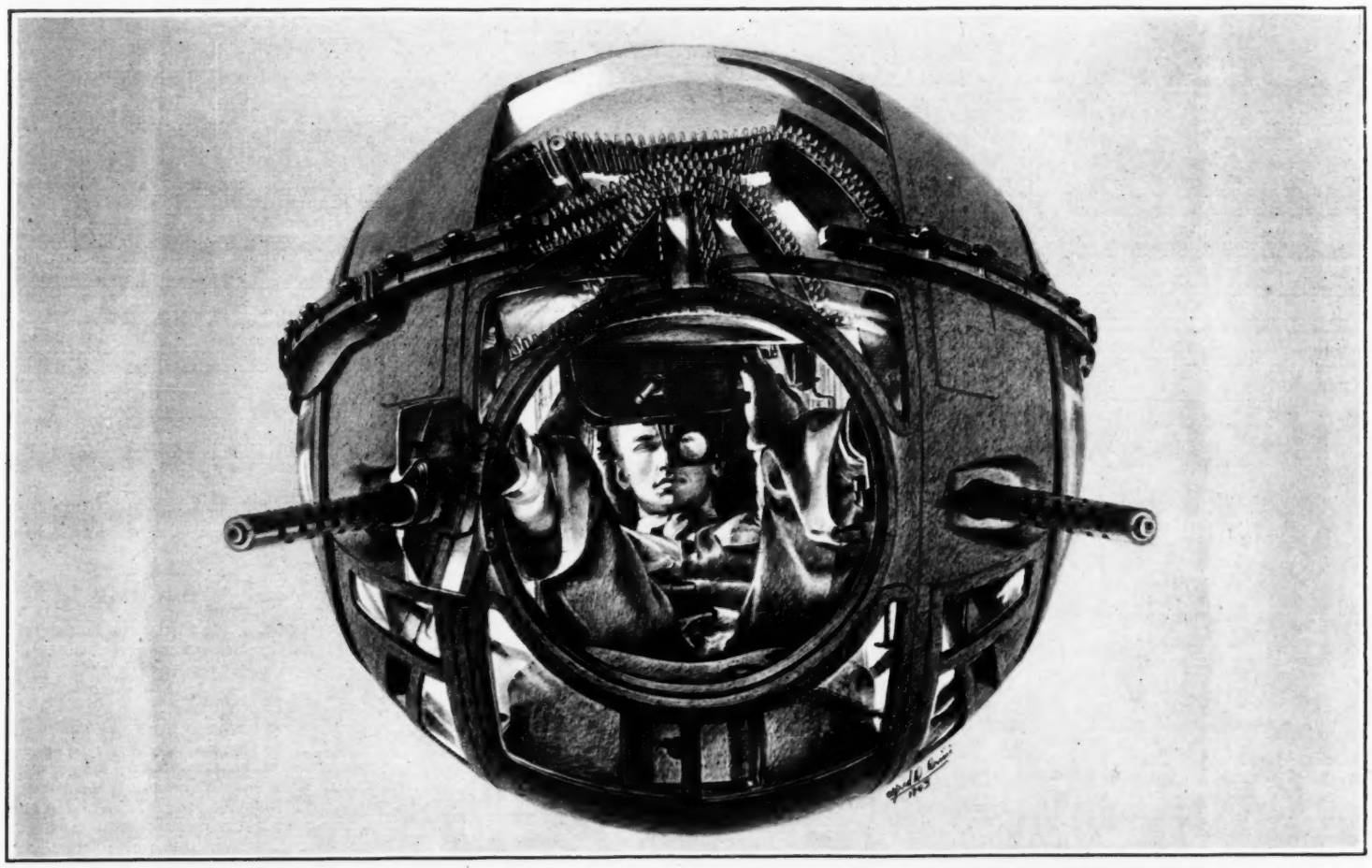
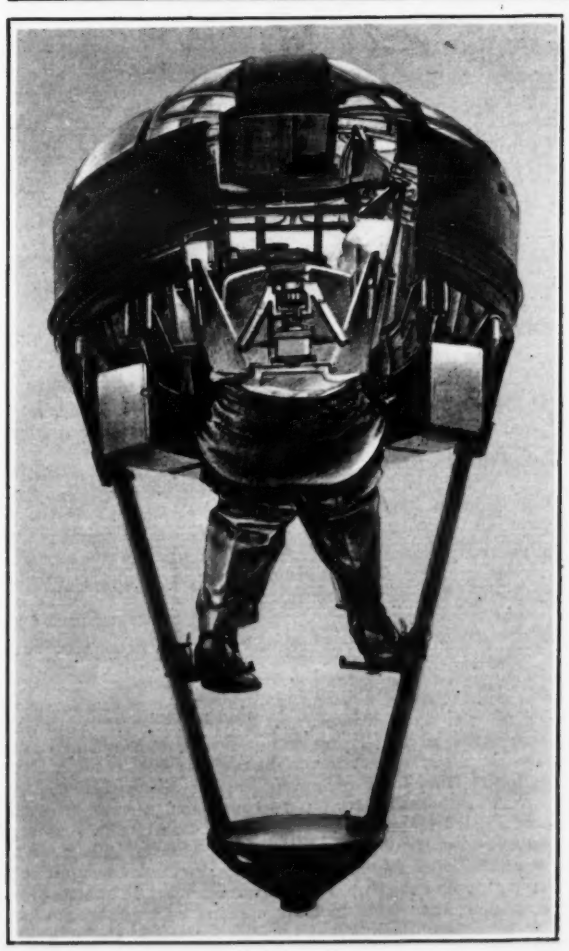
SATURDAY, MAY 6, 1944.



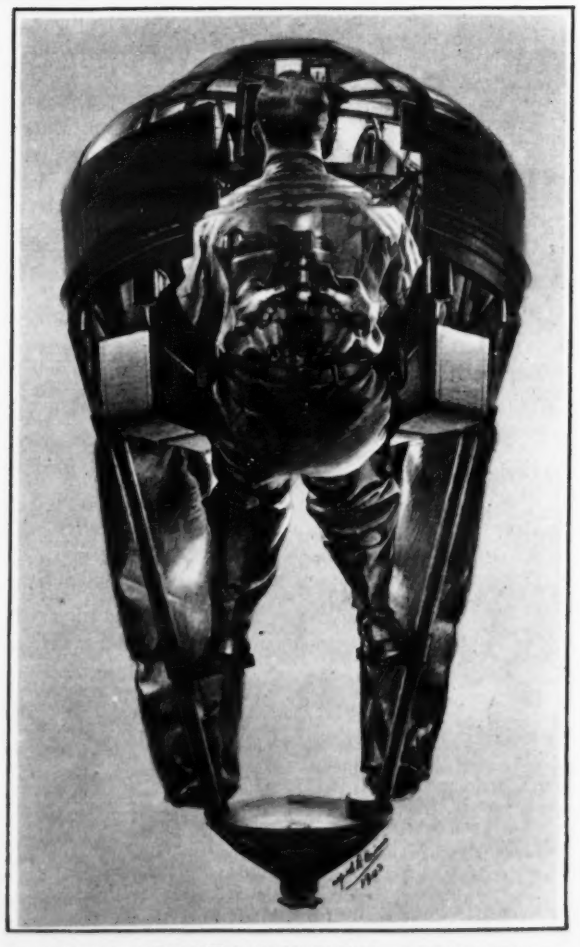


(ABOVE.) PEERING THROUGH HIS AUTOMATIC COMPUTING SIGHT, THE BALL TURRET GUNNER OF A HEAVY U.S. BOMBER HOLDS AN ATTACKING AIRCRAFT BETWEEN TWO VERTICAL HAIRLINES WHILE THE MECHANICAL BRAIN HOUSED IN THE SIGHTING APPARATUS WORKS OUT THE ENEMY 'PLANE'S RELATIVE COURSE, SPEED, AND RANGE, TRANSLATING THE CORRECT ANSWER THROUGH MECHANISM WHICH AUTOMATICALLY AIMS THE GUNS.

(LEFT.) THE SAME APPARATUS IN USE IN THE TOP GUN TURRET OF A BOMBER. THE DRAWING SHOWS ONLY THE LOWER HALF OF THE GUNNER, SO AS TO REVEAL THE LEVERS AND RANGE DIAL WITH WHICH HE KEEPS HIS TARGET BOXED BETWEEN HAIRLINE GUIDES.

(RIGHT.) A SIMILAR VIEW OF THE UPPER TURRET, THIS TIME SHOWING THE GUNNER'S HANDS, THROUGH HIS PARTIALLY TRANSPARENT BODY, GRIPPING THE LEVERS OF HIS AUTOMATIC SIGHTING APPARATUS.

THESE drawings, by Alfred D. Crimi, illustrate one of the latest products of the famous Sperry Gyroscope Company—an automatic gunsight used in U.S. bombers. Peering through the sight, the gunner holds his target between two vertical hairlines, which he expands or contracts as the target approaches or recedes. Meanwhile, a mechanical brain housed in the apparatus works out the relative course and speed of the target—usually an enemy aircraft—computes it with other data, and, arriving at the correct answer with incredible speed, translates it through complicated mechanism into an automatic aiming of the guns. Explanatory diagrams of the gunsight will be found on a following page of this issue.



A MECHANICAL "BOX OF TRICKS" WHICH AIMS AIRCRAFT GUNS WITH MORE-THAN-HUMAN ACCURACY.

By ARTHUR BRYANT.

THE financial experts' plan for international monetary stabilisation is full of interest. It also appears, in the belief of its architects and sponsors, to be full of hope. This, however, probably depends on factors outside the control of experts. Given a general measure of support for the pre-war economic order of things, the plan—a most ingenious technical instrument—has much to commend it. It ought, at the very least, to save the world from some of the more extravagant maladjustments of the pre-war international commercial and financial scene.

Yet I gravely doubt whether the world after the war is going to accept the basis of its old economic system. That basis was the assumption that the production of future wealth must be governed by the existing claims, or money-rights, of those in present possession of such claims: in other words, by credit created by loan. The question is whether mankind is going to tolerate this system, in spite of all its many virtues, any longer. It is not so much that such money-rights are inequitably distributed—they always have been—that threatens the system based on them. It is that they have proved inadequate to get the wealth the world requires produced. And the world has learnt during the past four years that it is perfectly possible to create such wealth. It has seen new wealth, though in the perverted form of superb and wonderful weapons of destruction, pouring from the factories into the skies and on to the battlefields in a prodigal abundance that makes the maddest extravagance of the richest millionaire seem in comparison like a miser's Saturday night out. Industrial man has learnt his power since Hitler marched into Poland. It is going to take more than a banker's formula or an economist's treatise, however ingenious, to make him forget it.

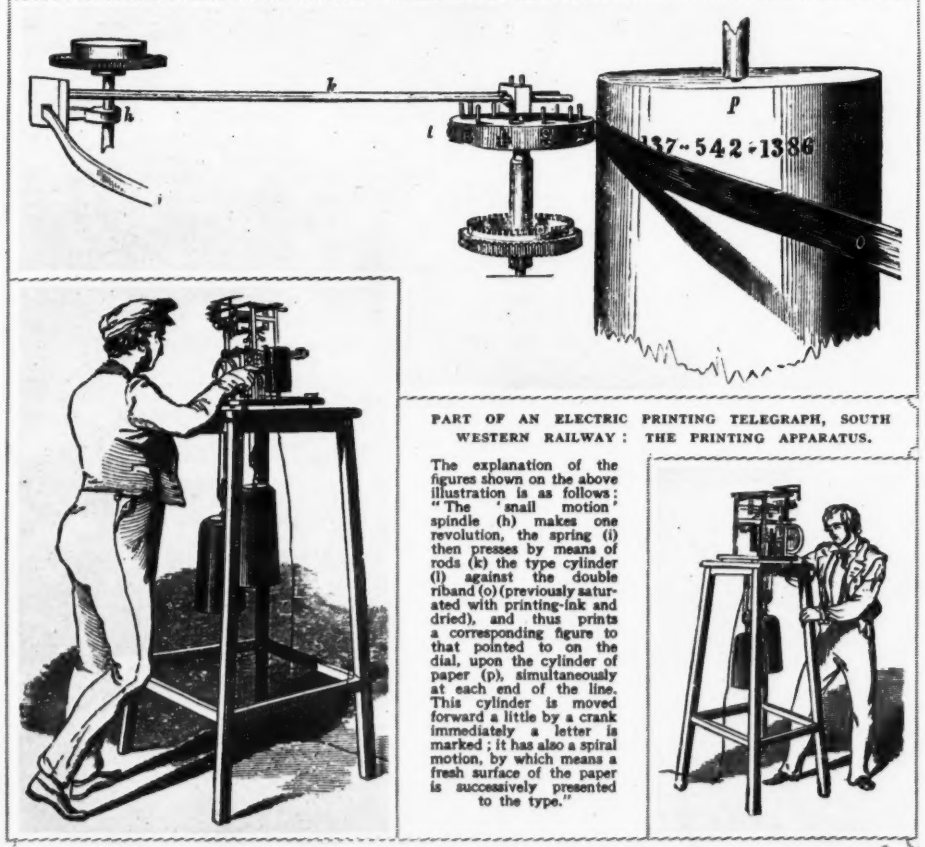
For the real issue seems now as plain as the flares and barrage in the night sky over the European cities. It is not whether man in the mass is going to be content with his niggardly portion of pre-war wealth—the slum, the cheap provision-shop and, in bad times, the dole queue. It is whether he is going to create the wealth which he needs and now knows he can create, or whether he is going—as at present—to destroy himself in fighting, with the very means discovered for creating such wealth, for the inadequate measure of wealth available under the pre-war economic and financial system. So long as he accepts the limitations of the latter, new wealth cannot—if the past be any guide—be made quickly enough to satisfy his clamorous needs, and he will continue to suffer the frustration of indigent unemployment, in a lesser or greater degree. He will, therefore, tend to fight—internationally and internally—in order to seize from others the wealth which he so urgently requires. He will, in other words, continue to assume that the problem is one of distribution instead of one of production, and, because he is in need when the world is so potentially rich, he will quarrel with everyone richer than himself. In that event, the scientific and mechanical power which might be used to satisfy his material needs will continue to be used—as at present—to his utter undoing. The story of the Tower of Babel will be re-enacted to its bitter conclusion.

Personally, I do not believe that man is going to destroy himself in this way. I believe that he is going to find the means to create the wealth he needs with the machines with which science has endowed him. If it were not for the Union of Soviet Socialist Republics, I should have my doubts. I am no fanatic admirer of all the manifestations of the Soviet experiment, and in the past I have at times been—perhaps very unjustly—a severe critic of it. But to-day I say with millions of my countrymen, "Thank God for Russia." And that not only for what Russia has done and is doing on the battlefield. I am as grateful for what, as I believe, Russia is going to do after the war. I can, of course, conceive it possible that the U.S.S.R., with its immense military and industrial power, might one day become a menace to the peace and liberty of the world and of this country. But if it should ever by ill hap do so, it will, I believe, be largely due to our own blindness and narrowness of sympathy. For, writing in the light of what has happened since the summer of 1941, I feel convinced that, once the menace of Hitler's Germany and Tojo's Japan has been removed, the peoples of the Soviet Union are going to read the world an astonishing object-lesson in the art of creating the kind of wealth for which the common man all the world over is asking. And in the light of that spectacle it is going to be harder than ever to get the common man, in this or any other country, to accept the frustration of simultaneous indigence and unemployment. Yet, unless our monetary experts are going to invent a machinery for creating purchasing power—untied by debt and its concomitant, crushing taxation—I am afraid that the result of all the new labour-saving machinery that war, with its urgent necessities, has created in every belligerent land, is going to be to increase unemployment. For, by reducing the number of wage-earners in every country, it is going to reduce the amount of purchasing power in circulation and so diminish the demand for its own products. Once the initial replacement boom of the immediate post-war years is over—and it may be over much quicker than we think—the danger is going to arise of an even greater volume of unemployment than that which followed the mechanical and scientific inventions of the last war.

The social peril in such a situation is obvious. Unemployed and under-satisfied men—even in this traditional home of individual freedom, and in the United States, too—are likely to compare their lot unfavourably with that of the citizens of the U.S.S.R., until recently among the most backward of peoples economically. In the light of what they see, they may then become ready to discard individual liberty and all its venerable safeguards—*habeas corpus*, freedom of the Press, the right of the producer to sell his labour where he pleases and of the consumer to buy where he pleases—for an authoritarian system of economic and social regimentation which, however congenial it may be to the Russian temperament, would certainly not be so for long to the British. Indeed, paradoxically, as Russia moves (as I believe she will move), under the maturing influence of an era of plenty, towards a new and wider conception of individual liberty, it is possible that this country and America, under the harshening effects of mass poverty, unemployment and resulting social bitterness, might move in the opposite direction. It may sound inconceivable, but let us not forget that 150 years ago, this country, which had long been in its rural well-being and culture the exemplar of the world, lost through a fatal error its free peasantry and yeomanry at the very moment that France—formerly a byword for rural poverty and repression—gained hers.

Yet I refuse to believe that the country which, after all her errors and blindness, saved the world in 1940 and which has done such great things since, is going to lose her opportunity—and mankind's—by a blind subservience to a mechanical accountancy and to the vested interests of an outworn and restrictive conception of usury. My faith—and I am writing this on St. George's Day—is that an England, now in its new-found power and might about to storm the beaches where, in its pathetic weakness four years ago, it showed such constancy and courage, will after victory rise superior to the dead hand of the past. I believe that, relying both on her latent common sense and her newly-revived spirit of adventure—eschewing, that is, the counsel both of cranks and cravens—she will evolve a system of creating new purchasing power and credit that will both harness the starved creative powers of her people and preserve her ancient birthright of individual freedom. And I take the two great speeches on the future of the Empire delivered by Mr. Churchill and Mr. Shinwell in the Commons on the eve of St. George's Day as a token of that impending, if still distant, dawn. We can open the doors of a real merry England to our children if we have only the courage and the sanity to do so. The whole civilised world is waiting for us—first for our victory and then for our right use of it.

ONE HUNDRED YEARS AGO: REPRODUCTIONS AND QUOTATIONS FROM "THE ILLUSTRATED LONDON NEWS" OF MAY 4, 1844.



PART OF AN ELECTRIC PRINTING TELEGRAPH, SOUTH WESTERN RAILWAY: THE PRINTING APPARATUS.

The explanation of the figures shown on the above illustration is as follows: "The 'snail motion' spindle (h) makes one revolution, the spring (i) then presses by means of rods (k) the type cylinder (l) against the double riband (o) (previously saturated with printing-ink and dried), and thus prints a corresponding figure to that pointed to on the dial, upon the cylinder of paper (p), simultaneously at each end of the line. This cylinder is moved forward a little by a crank immediately a letter is marked; it has also a spiral motion, by which means a fresh surface of the paper is successively presented to the type."

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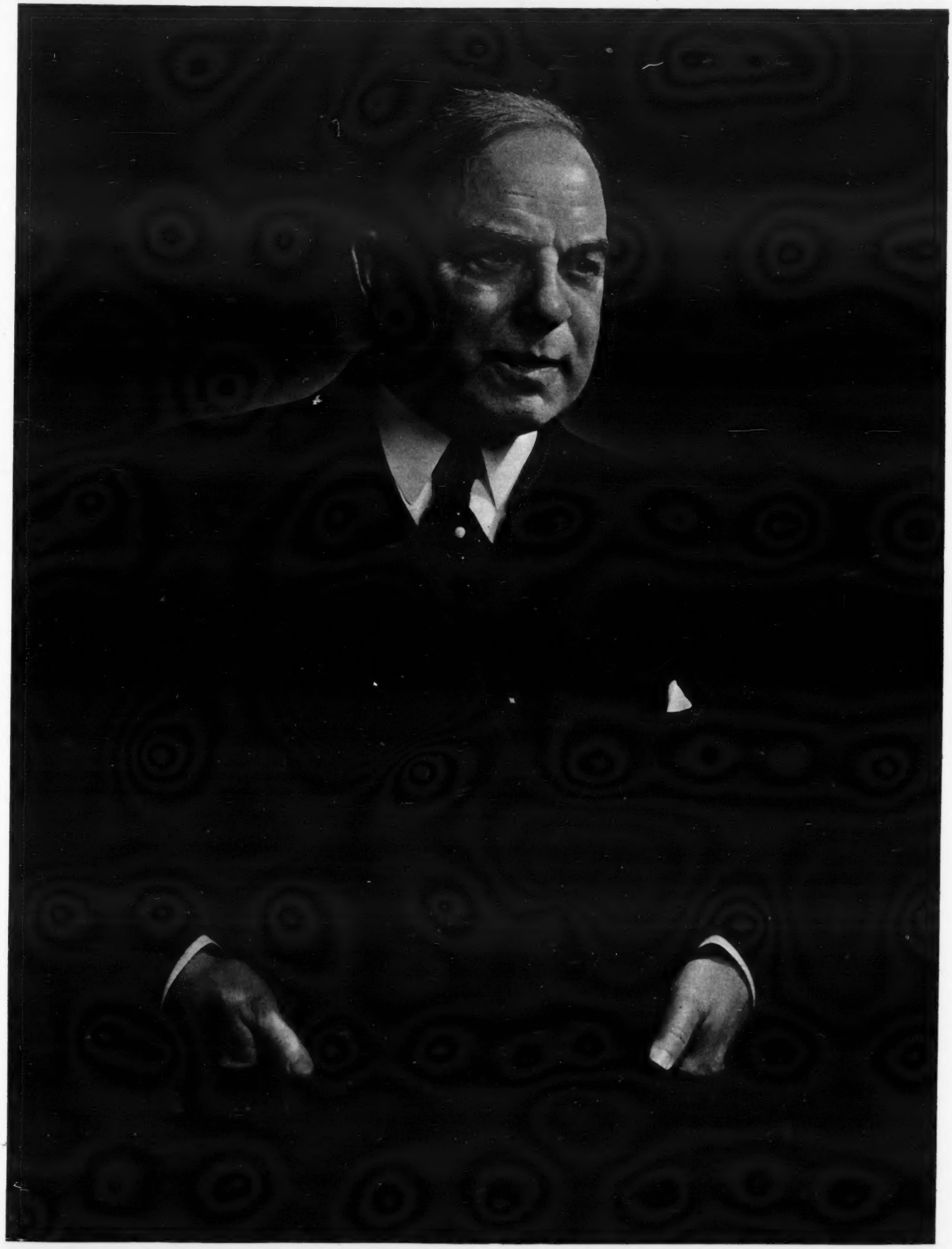
"To Mr. Alexander Bain is due the merit of discovering that an effective voltaic battery may be formed by employing the moisture of the earth as the exciting fluid; and that at whatever distances apart the generating plates may be placed, an electric current is formed when communication is made between those plates by an external conducting wire. . . . Mr. Bain has applied this interesting discovery to work his electric printing telegraph . . . and one has been placed experimentally . . . from Nine Elms to Wimbledon, a distance of 6 miles . . . and, with a single pair of plates of zinc and copper, of but one sq. ft. surface, the electricity generated is more than sufficient for the purposes required."



MEN WHO SHAPE OUR DESTINIES: NO. 18—THE RT. HON. W. L. MACKENZIE KING, PRIME MINISTER, PRESIDENT OF THE PRIVY COUNCIL AND SECRETARY OF STATE FOR EXTERNAL AFFAIRS, CANADA.

No. 18 in our series "Men Who Shape Our Destinies" is an exclusive portrait study by Y. Karsh, of Ottawa, of Mr. Mackenzie King, Prime Minister of Canada since 1935 and from 1921-30, except from June 28 to September 25, 1926. He represented Canada at the Imperial Conferences in London in 1923, 1926 and 1937; was a Member of Council and Vice-President, Assembly, of the League of Nations in Geneva during 1928 and 1936, and attended the Coronation of King George VI. in 1937. Mr. Mackenzie King concluded the Ogdensburg Park Declaration with President Roosevelt in August 1940 and the Hyde Park Declaration in April 1941. He is now in this country to attend the Conference of Dominion Prime Ministers which is due to open in London shortly. He was last here in 1941.

(ABOVE.) RATINGS MANŒUVRE DEPTH-CHARGES INTO POSITION AS A CANADIAN FRIGATE FIGHTS HER WAY THROUGH HEAVY SEAS.
(BELOW.) A BREAKING SEA BOILS OVER AND UNDER THE STERN DEPTH-CHARGE RAILS OF A CANADIAN FRIGATE ON CONVOY DUTY.

FIGHTING SHIPS OF THE ROYAL CANADIAN NAVY IN ACTION AGAINST

H.M.C.S. "PRINCE ROBERT," CANADA'S FIRST ANTI-AIRCRAFT CRUISER, ATTACKING A U-BOAT: GUNNERS WATCH A DEPTH-CHARGE EXPLOSION.

These striking Royal Canadian Navy photographs illustrate incidents in the Battle of the Atlantic, in which Canada's fighting ships have played a gallant rôle. The virtual victory secured by the Allies against Hitler's U-boat packs would have been delayed, if not impossible, without the early intervention of Canadian corvettes and, later, frigates of the type illustrated on the left-hand page. These frigates, a development of the corvette on a much larger and better-equipped scale, carrying a bigger complement of men and being more heavily armed, are the newest and deadliest weapon Canada has produced for the destruction of U-boats. Their presence on the convoy routes has had a salutary effect. The photograph at top left is by Lieut. G. Milne, R.C.N.V.R.; and the one taken on board the "Prince Robert" by Lieut. H. J. Nott, R.C.N.V.R.

U-BOAT PACKS IN THE VICTORIOUS BATTLE OF THE ATLANTIC.

LOVE OF NATURE AND NATURAL THINGS.

*"THE WAY OF A COUNTRYMAN": By SIR WILLIAM BEACH THOMAS.**

An Appreciation by SIR JOHN SQUIRE.

N.B.—The illustrations on this page are not from the book.

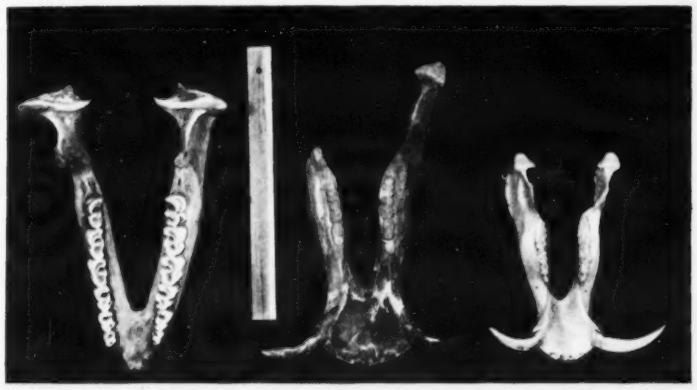
SIR WILLIAM BEACH THOMAS, AUTHOR OF "THE WAY OF A COUNTRYMAN," THE BOOK REVIEWED ON THIS PAGE.

Sir William Beach Thomas, educated at Shrewsbury and Christ Church, Oxford, has a long list of publications to his credit besides being a regular contributor to the "Observer" and "Spectator." His works include "The English Year"; "With the British on the Somme"; "The Yeoman's England"; "The English Landscape," etc.

SIR WILLIAM BEACH THOMAS was born in 1868; is still as young in heart and brain as ever he was; refuses to rest on his many laurels; and finishes a very modest autobiography of only 200 pages with a chapter on the future of the English countryside. I say "his many laurels" advisedly. When he was knighted he was knighted as one of several eminent war correspondents at the front in France in the last war. But before that he had several careers; and since that he has renewed and increased a reputation as one of the most versatile and best-informed of all the writers who have ever written about the English countryside, and its flora and fauna, which latter term includes human beings. Those many readers who look forward each week to his notes in the *Spectator* and the *Observer* on all sorts of things, from rainbows to rural housing, from hoopoes to the planting of French dwarfs, hardly remember that he was a war correspondent at all. And those who do must be old indeed to remember that he was in early days a remarkable athlete. He went to Christ Church as a classical exhibitioner from Shrewsbury, and at once demonstrated his versatility by playing rugger, soccer and cricket for his college, escaping the boat only because there wasn't time for it, becoming President of the O.U. Athletic Club, and breaking the inter-University record for the quarter-mile. He is still a little shocked to think that when he first came to London looking for a job as a journalist he was fobbed off until his athletic record was disclosed, when he was eagerly snatched at. By the same token, he is rather shocked to recollect that the two most famous men produced by his old school were Sir Philip Sidney and Charles Darwin, and that everybody at school knew about Sidney and nobody ever mentioned Darwin. But he need not be shocked, or even doubtful. Would any healthy man, with a brood of sons at this crisis, prefer to have produced a row of Charles Darwins to a row of Philip Sidneys? Bernard Darwin, to whom rightful tribute is paid in these pages, is quite another matter. He has, in my view, done much more for civilisation than his illustrious, humble, selfless, patient grandfather, who meant them. The more talk there is about stopping ribbon-development, the more ribbon-development there is. The expansion of our country towns is governed by drain-pipes and their congeners, which prefer straight lines. The French Revolution set up, quite formally, a Goddess of Reason; the Russian Revolution, without saying so, adopted a Goddess of Traction; a visitor from Mars might well suppose that England bowed at the shrines of the Goddess Hygieia and some vague Great Plumber of the Universe. The oak, the beech and the ash dwindle; and the Forestry Commission plants great wildernesses of conifers everywhere, monotonous northern things, hostile to bird, beast and flower, and symbolical in the rapidity of their growth and the flimsiness of their texture of the get-rich-quick civilisation in which we live. We are threatened with the large-scale mechanised farm, a further reduction of land-workers, the wholesale use of artificial fertilisers, and the extirpation of the hedges which house the small birds which eat the insects. We are threatened with all sorts of other perils to which our attention is constantly directed by that very polished Jeremiah, Mr. H. J. Massingham, to whom Sir William refers as "no farmer, but perhaps the best of all present writers on rural England"—which is a beautiful instance of the opposite of the pot calling the kettle black.

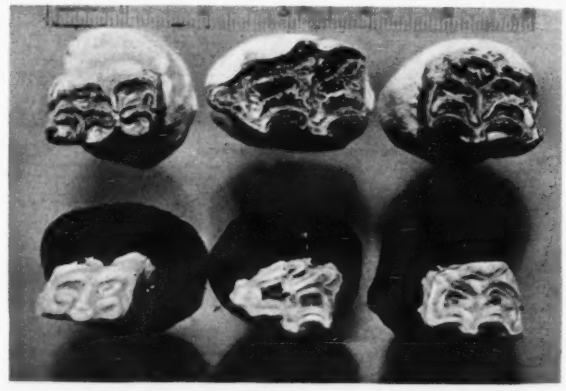
ONE OF THE MOST IMPORTANT PREHISTORIC DISCOVERIES IN THE HISTORY OF AFRICAN ARCHÆOLOGY: THE MAIN SITE OF OLORGASAILIE, KENYA. THE STONE-LIKE OBJECTS ARE HUNDREDS OF HAND-AXES AND CLEAVERS WHICH HAVE BEEN EXODED FROM THE LIVING FLOOR.

But it is no good merely bleating when the outlook seems black. Cassandra herself might perhaps have employed herself more usefully had she occasionally given her sombre vaticinations a rest and started a Council for the Preservation of Troy. It is refreshing to find Sir William, the old warrior, still stout at heart and hoping. He ends:



THE JAW OF A GIANT FOSSIL PIG (CENTRE), FOUND AT OLORGASAILIE, COMPARED WITH THAT OF A MODERN BLACK RHINOCEROS (LEFT) AND WITH THAT OF THE GIANT FOREST HOG (RIGHT).

The site of this important archæological discovery is in the Great Rift Valley, near Mount Olorgasailie, in Kenya, and already great numbers of fossilised animal remains and prehistoric stone implements have been uncovered. The fossils and remains are largely those of the Acheulean culture of the Middle Pleistocene Age. Olorgasailie site was first located early in 1942, and a systematic exploration was started by Dr. L. S. B. Leakey, Honorary Curator of the Coryndon Museum, and Mrs. Leakey, and carried on last summer. The deposits consist of lake beds alternating with land surfaces, and upon four of the land surfaces exposed there are abundant signs of occupation by Acheulean man, and very large numbers of hand-axes, cleavers and bolas stones have been found.

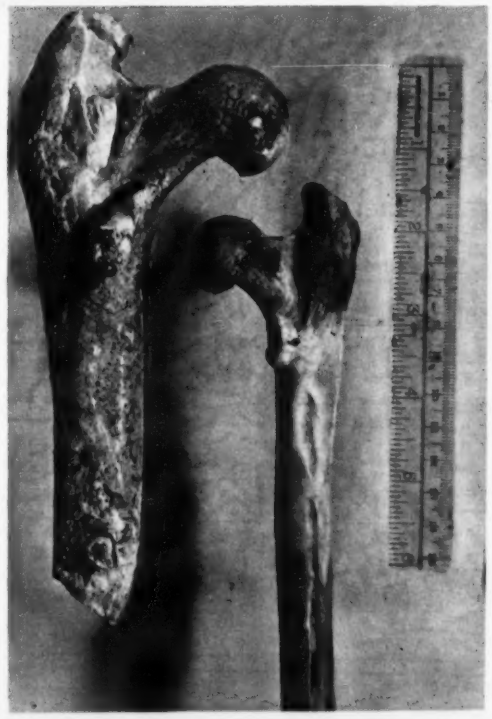


THREE TEETH FROM THE JAWS OF GIANT FOSSIL MEMBERS OF THE HORSE FAMILY (TOP ROW), COMPARED WITH THOSE OF THE BIGGEST LIVING ZEBRA (BOTTOM ROW).

very well but inadvertently contributed a great deal to the modern delusions about automatic progress and the possibility of speeding up the race to an impossible Earthly Paradise.

The book, short as it is (though, owing to paper economy, and close print, it isn't as short as it seems), is just what Sir William's devotees would expect and wish for. The reader is conducted from Little Gidding to the South Island of New Zealand, in company with a quiet observer with immense knowledge, unflagging interest, and a perfectly natural prose style which he may have caught when young from the quiet Oxfordshire streams. Now we are at the front in the last war; now we are on a lonely island watching gannets; and the persons we meet range from Northcliffe to T. E. Lawrence. The book is "the harvest of a quiet eye"; in the tradition of Jefferies of Hudson's "Far Away and Long Ago," but oxygenated by a sense of humour which Hudson did not possess, and of which Jefferies had not a great deal. It will be a pocket-book to generations of young lovers of their country yet unborn who will continue in his faith that "the village is the ideal place for the nursery of man." And it is all the more English in that (following Kipling's maxim) one foot of the compass wanders over the world, while the other stays put. "I once sent two fox-hounds to a friend in the Argentine" is the typical opening of a discursion. Why? Well, read the book and see.

Sir William's last chapter is called "This England—and After," and is headed with a quotation from Shelley: "I change, but I cannot die." It is bravely thought and bravely spoken. There are moments when anybody who loves the scenery and traditions of this small island, which Shakespeare significantly called "This England," must feel rather depressed. Our ancient monuments lived under a continual threat long before the Germans were after



PART OF THE FEMUR OF A GIANT FOSSIL BABOON (LEFT), COMPARED WITH THE FEMUR OF A LARGE SPECIMEN OF THE LIVING SPECIES OF BABOON, *PAPIO NEUMANNI*.

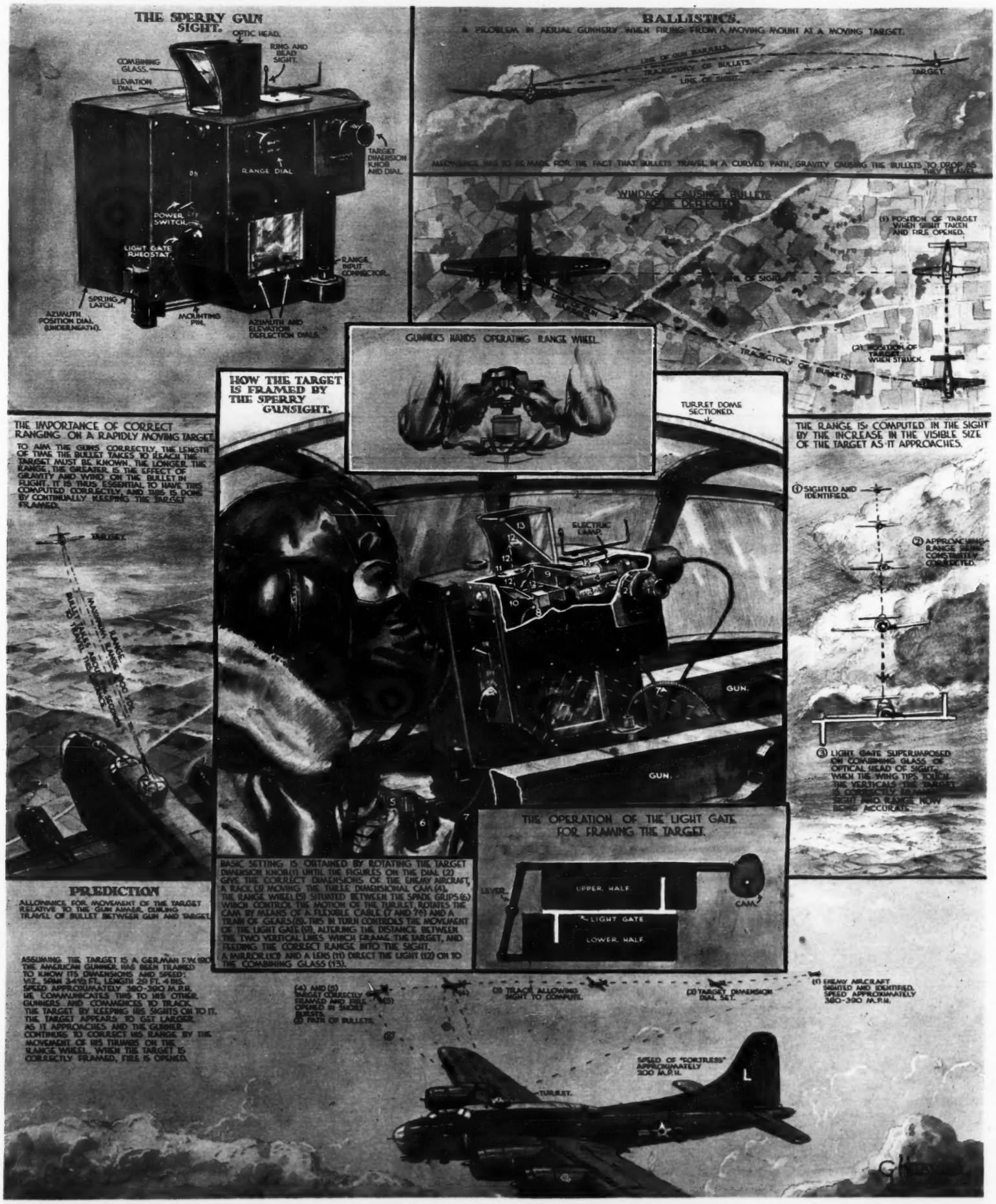
"England, as the phrase goes, is a humanized scene; it is like the town, man-made. Man destroyed the grim and dangerous forests, built villages and homesteads, and fenced fields. When all is said, in land the necessity is not the half-negative work of preservation, but the direction of the new humanisation. Let farming be made in reality the first industry, in popular affection as in economic fact. If flourishing farms are encircled by a 'silver girdle' untarnished by foul essences, all will be well with the England that is to be. It will in most other regards preserve itself. Let the planners look to the towns, which need not negative preservation, but reconstruction. What countrymen fear is the grim experiment in homœopathy by which the planners propose to cure the evils of the towns by urbanising the country."

The pessimists will comment that once more the urban population (which, with universal suffrage, must rule the roost) will be tempted by demagogues to abandon British farming for the sake of cheap breakfasts, will resume its belief that food grows in tins, and, should we be faced with another war, will once more bring us to a state of things when it is touch and go as to whether the submarines starve us out. But nobody ever won a battle by telling his troops that they were bound to be beaten: which is even worse than saying, "Of course, we shall muddle through." We must all do our best in our small corners; "the country is sound at heart" is an old phrase and true; and considerable encouragement may be derived from the fact that the planners (who never seem to be countrymen, farmers, or even farm-labourers) do not agree with each other. Utopias tend to cancel each other out, as we do not all want to go to the same place. I seem to remember that in Mr. Wells's "Modern Utopia" (I hope he will forgive me if I am ascribing to him a notion of some other Utopian) the trains ran so smoothly that the Supermen were able to play billiards on them. But who the deuce wants to play billiards in a train? Many of us would willingly do without the trains themselves.

* "The Way of a Countryman." By Sir William Beach Thomas. (Michael Joseph; 10s. 6d.)

A MECHANICAL BRAIN: THE SPERRY AUTOMATIC COMPUTING GUN-SIGHT.

DRAWN BY OUR SPECIAL ARTIST, G. H. DAVIS, IN CO-OPERATION WITH THE SPERRY GYROSCOPE CO. OF AMERICA.


THE SPERRY GUN SIGHT.
OPTIC HEAD.
RING AND BEAD SIGHT.
COMBINING GLASS.
ELEVATION DIAL.
ON
RANGE DIAL
TARGET DIMENSION KNOB AND DIAL.
POWER OFF SWITCH.
LIGHT GATE RHEOSTAT.
RANGE INPUT CONNECTOR.
SPRING LATCH.
AZIMUTH POSITION DIAL (UNDERNEATH).
MOUNTING PIN.
AZIMUTH AND ELEVATION DEFLECTION DIALS.
BALLISTICS.
A PROBLEM IN AERIAL GUNNERY WHEN FIRING FROM A MOVING MOUNT AT A MOVING TARGET.
LINE OF GUN BARRELS.
TRAJECTORY OF BULLETS.
LINE OF SIGHT.
TARGET.
ALLOWANCE HAS TO BE MADE FOR THE FACT THAT BULLETS TRAVEL IN A CURVED PATH, GRAVITY CAUSING THE BULLETS TO DROP AS THEY TRAVEL.
WINDAGE CAUSING BULLETS TO BE DEFLECTED.
(1) POSITION OF TARGET WHEN SIGHT TAKEN AND FIRE OPENED.
LINE OF SIGHT.
LINE OF GUN BARRELS.
TRAJECTORY OF BULLETS.
(2) POSITION OF TARGET WHEN STRUCK.
GUNNER'S HANDS OPERATING RANGE WHEEL.
HOW THE TARGET IS FRAMED BY THE SPERRY GUNSIGHT.
TURRET DOME SECTIONED.
ELECTRIC LAMP.
GUN.
THE IMPORTANCE OF CORRECT RANGING ON A RAPIDLY MOVING TARGET.
TO AIM THE GUNS CORRECTLY, THE LENGTH OF TIME THE BULLET TAKES TO REACH THE TARGET MUST BE KNOWN. THE LONGER THE RANGE, THE GREATER IS THE EFFECT OF GRAVITY AND WIND ON THE BULLET IN FLIGHT. IT IS THUS ESSENTIAL TO HAVE THIS COMPUTED CORRECTLY, AND THIS IS DONE BY CONTINUALLY KEEPING THE TARGET FRAMED.
TARGET.
MAXIMUM RANGE.
BULLET TAKES ABOUT TWO SECONDS TO REACH TARGET.
THE RANGE IS COMPUTED IN THE SIGHT BY THE INCREASE IN THE VISIBLE SIZE OF THE TARGET AS IT APPROACHES.
(1) SIGHTED AND IDENTIFIED.
(2) APPROACHING, RANGE BEING CONSTANTLY CORRECTED.
(3) LIGHT GATE SUPERIMPOSED ON COMBINING GLASS OF OPTICAL HEAD OF SIGHT. WHEN THE WING TIPS TOUCH THE VERTICALS THE TARGET IS CORRECTLY FRAMED, SIGHT AND RANGE NOW BEING ACCURATE.
PREDICTION
ALLOWANCE FOR MOVEMENT OF THE TARGET RELATIVE TO THE GUN AIMER, DURING TRAVEL OF BULLET BETWEEN GUN AND TARGET.
ASSUMING THE TARGET IS A GERMAN F.W. 190, THE AMERICAN GUNNER HAS BEEN TRAINED TO KNOW ITS DIMENSIONS AND SPEED; VIZ., SPAN 34-10 FT., LENGTH 29 FT. 4 INS., SPEED APPROXIMATELY 380-390 M.P.H. HE COMMUNICATES THIS TO HIS OTHER GUNNERS AND COMMENCES TO TRACK THE TARGET BY KEEPING HIS SIGHTS ON TO IT. THE TARGET APPEARS TO GET LARGER AS IT APPROACHES AND THE GUNNER CONTINUES TO CORRECT HIS RANGE BY THE MOVEMENT OF HIS THUMBS ON THE RANGE WHEEL. WHEN THE TARGET IS CORRECTLY FRAMED, FIRE IS OPENED.
BASIC SETTING IS OBTAINED BY ROTATING THE TARGET DIMENSION KNOB (1) UNTIL THE FIGURES ON THE DIAL (2) GIVE THE CORRECT DIMENSIONS OF THE ENEMY AIRCRAFT. A RACK (3) MOVING THE TURRET DIMENSIONAL CAM (4). THE RANGE WHEEL (5) SITUATED BETWEEN THE SPADE GRIPS (6) WHICH CONTROL THE MOTION OF THE TURRET, ROTATES THE CAM BY MEANS OF A FLEXIBLE CABLE (7 AND 7A) AND A TRAIN OF GEARS (8). THIS IN TURN CONTROLS THE MOVEMENT OF THE LIGHT GATE (9), ALTERING THE DISTANCE BETWEEN THE TWO VERTICAL LINES WHICH FRAME THE TARGET, AND FEEDING THE CORRECT RANGE INTO THE SIGHT. A MIRROR (10) AND A LENS (11) DIRECT THE LIGHT (12) ON TO THE COMBINING GLASS (13).
THE OPERATION OF THE LIGHT GATE FOR FRAMING THE TARGET.
LEVER.
UPPER HALF.
CAM.
LIGHT GATE.
LOWER HALF.
(4) AND (5) TARGET CORRECTLY FRAMED AND FIRE OPENED IN SHORT BURSTS.
(3) PATH OF BULLETS.
(3) TRACK ALLOWING RIGHT TO COMPUTE.
(2) TARGET DIMENSION DIAL SET.
(1) ENEMY AIRCRAFT SIGHTED AND IDENTIFIED. SPEED APPROXIMATELY 380-390 M.P.H.
SPEED OF "FORTRESS" APPROXIMATELY 300 M.P.H.
TURRET.

EXPLANATORY DIAGRAMS OF AN INVENTION WHICH HAS ENABLED U.S. BOMBERS TO SCORE BIG "KILLS" OF ENEMY FIGHTERS.

Problems facing the air gunner are more formidable than those which trouble the gunner on the ground. For one thing, the airman has to fire from a *moving* platform at a moving target; for another, the ballistics involved are more complicated by reason of the aircraft's speed, which forces the bullet backward off its true course. In the past, therefore, aerial gunnery has been very much a matter of trial and error. The gunner has had to estimate the range and relative speed of an enemy aircraft with the aid of one or more rings on his sighting apparatus. The accuracy of his fire has depended on the amount of practice he has had, combined with the time available to him for making the necessary calculations. These calculations are now made by a mechanical brain—an automatic computing gun-sight produced by the Sperry Gyroscope Co. of America, and now in use in American bombers. In using the gun-sight, the gunner, first recognising the type of enemy aircraft attacking, and knowing its dimensions, quickly sets his sighting apparatus accordingly, then frames his target between two hairlines forming the "light gate." Meanwhile, the mechanical brain, having the original dimensions of the target to work on as basic details, calculates them in conjunction with considerable other data, and translates the result of the calculations through machinery which automatically ranges and aligns the gun-barrels. When the wing-tips of the attacking aircraft exactly span the "light gate," the gunner presses the firing-button, and the guns fire with a degree of accuracy far in advance of anything yet achieved in aerial warfare. This mechanical brain is one of the newest products of the company responsible for the famous Sperry bomb-sight and automatic pilot

MOST MASSIVE AIR EXERCISES PRIOR TO EUROPE'S INVASION:

BIGGEST AIR EXERCISE OF AIRBORNE TROOPS, PRELIMINARY TO THE INVASION OF EUROPE: PARATROOPS EMBARKING IN FULL EQUIPMENT FOR THEIR DESTINATION, TO ATTACK AN "ENEMY" STRONG-POINT.

THE OBJECTIVE IS REACHED AND THE PARATROOPS FOLLOW ONE ANOTHER RAPIDLY TO TAKE THE JUMP. SCORES OF GLIDER 'PLANES AND TOW-PLANES WERE LANDED WITHOUT MISHAP IN THIS MASSIVE, LARGE-SCALE DEMONSTRATION RECENTLY.

EQUIPMENT IS SHOWERED DOWN FROM THE SKIES: HERE A PARATROOP, AFTER A SAFE DESCENT, IS UNPACKING AN EQUIPMENT CONTAINER. A LONG LINE OF OTHER PARATROOPS ARE MEANTIME NEARING THE EARTH.

AN EQUIPMENT CONTAINER UNDERGOING FINAL ADJUSTMENT BEFORE IT IS LIFTED BY 'PLANE TO ITS DESTINATION AND RELEASED. GUNS, AMMUNITION, CYCLES, AND A HOST OF OTHER NECESSARIES ARE ALL DROPPED OVER THE APPOINTED ZONE, AND EVERYTHING WORKS TO A PRECISION TIME-TABLE.

Troop-carrying aircraft of the United States Ninth Air Force in April flew more than 30,000 hours in a series of midnight and dawn training operations over England. Towards the end of the month, aircraft of Brig.-General Paul L. Williams's Ninth Troop-Carrier Command carried out one of the most massive airborne operations of the war. The mission—a daybreak attack on an "enemy" strong-point—was executed realistically under severe battle conditions and with split-second precision. It was much like the job Troop-Carrier Command expects to be called upon to perform when the Second Front is opened up. In these combined operations, in which both U.S. and British troops participated, several hours before dawn the first C-47 transport 'planes reached the pre-appointed drop zone and discharged unit after unit of fully-armed paratroopers. Simultaneously, gliders came to earth on pastures and fields with cargoes of soldiers, guns, jeeps and heavy demolition equipment. As the troops stormed their objective, other gliders brought fresh units and supplies of food, ammunition, weapons, and medical equipment. By ten o'clock the same morning the objective was taken. Officers who commanded the practice operation said the C-47s and

ALLIED PARATROOPS IN NIGHTLY OPERATIONS OVER ENGLAND.

A PARATROOP PREPARES HIS EQUIPMENT FOR OPERATIONS ON LANDING. HE IS STRAPPING HIS KITBAG TO HIS LEG. IT CONTAINS WIRELESS AND OTHER NEEDED GADGETS IN THE IMMEDIATE FUTURE, WHEN HE ADVANCES TO HIS OBJECTIVE.

HAVING NOW COMPLETED THE SLINGING OF HIS KITBAG ON HIS RIGHT THIGH, HE PROCEEDS TO CLIP HIS PARACHUTE TO THE STATIC LINE. HE IS THEN READY FOR THE ORDER TO JUMP FROM THE GLIDER.

HERE PARATROOPS, HAVING MADE SAFE LANDINGS, PROCEED TO UNPACK THEIR AIRBORNE EQUIPMENT, WHICH, AS MAY BE SEEN, INCLUDES A LIGHT-WEIGHT MOTOR-CYCLE AND IS NOW BEING ASSEMBLED. EVEN JEEPS ARE THUS CONVEYED BY AIR.

AN INFANTRY SECTION HANDLING EQUIPMENT AFTER LANDING IN GLIDERS. THE EXERCISE WAS A DAYBREAK ATTACK UPON AN "ENEMY" OBJECTIVE, AND WITH SPLIT-SECOND PRECISION, THE SECTION MARCHES TOWARDS IT.

the GG4A gliders all reached the drop zones within a few seconds of scheduled time. At the end of their busiest month Troop-Carrier Command pilots said that their most difficult task was to steer clear of bombers and fighters proceeding on their way to targets on the Continent. The landing of the paratroops was quick work. Our pictures, taken during the final phase of the exercise, represent the large-scale combined manœuvres by the R.A.F., British and United States Armies. It was watched by Air Chief-Marshal Sir Arthur Tedder, Deputy Supreme Commander of the Allied Expeditionary Forces. Guns, ammunition, bicycles, and other equipment rained from the skies by parachute; while on the ground gliders poured out their load of troops, doctors, and stretcher-bearers. Within a space of twenty minutes scores of glider 'planes, carrying troops and equipment, were landed without a mishap on an English airfield, and our pictures show the men in their varying tasks, all performed strictly to a time-table. Meanwhile, as we go to press, preparations for the invasion of the Continent move on apace and acute nervousness has been displayed in Germany and German-occupied countries as to where the blow or series of blows will fall.

THE GREAT WORLD WAR:
AIR OFFENSIVE AGAINST GERMANY.

By CYRIL FALLS.

READERS who have had the patience to follow my weekly commentaries through the years during which they have been appearing in this paper will be aware that I have from time to time made some reservations on the subject of strategic bombing. Judging by the reproaches I occasionally receive, some of them may think that this is putting it mildly. Yet I remain unrepentant. I consider that we are entitled to speak our minds, provided that we do not thereby damage the cause for which the nation is fighting; and surely the provision of a little propaganda on the enemy's radio every now and then cannot be said to do that. The great point in favour of strategic bombing is that it enables damage to be done to the enemy which cannot be done in any other way. Yet this is true only in a relative sense, not in an absolute one. The surest of all means of preventing a port or an arsenal from functioning is to capture it, and if the resources put into bombing should become so disproportionate to the total resources available that neither of these objectives can ever be taken, then it may prove untrue to say that bombing is doing something which could not otherwise have been done. I recognise the place of strategic bombing in attack and in defence, but I am firmly anti-Douhet in principle. That is to say, I believe he exaggerated the power of bombing, both in direct effect and because he heavily underestimated the power of defence, restoration and recovery, dispersion, concealment, and indeed every factor which did not fit into his seemingly logical but actually unsound theories. And some of those who shape our destinies have fallen into his errors.

A notable characteristic of this age is national recklessness of consequences, of odds, of the means to an end. The limited objective seems to-day unknown in national policy. Except perhaps in the Napoleonic Wars, that was not true of the eighteenth and nineteenth centuries. These two centuries were indeed very different, but the cool, sceptical moderation of the former and the sentimental enthusiasm of the latter made somewhat similar contributions in this respect. The twentieth appear to have lost their sense of responsibility and their balance as well as their scruples. To-day, however, I am dealing not with humanity but with self-interest. From that point of view it is obvious why, in the first instance, this country pinned its faith to area bombing by night. The power of Germany, built up over a period of years with the deliberate intention of enslaving Europe, had torn other directly offensive weapons from its hands. But when the time came for the use of other weapons, a confused doctrine that night bombing alone could bring victory had been built up. This was, in fact, an impossibility, as most unprejudiced observers would, by now, admit. We had not the man-power or the resources for the task. If it had not been for the fact that our American ally came to our aid with a new policy and a new technique to support our offensive, and the resources to carry it out on a grand scale, our own efforts would have led to a dead end. Yet we had been so bewitched by our own theories that in the first instance some of their most prominent advocates regretted that the Americans had not adopted them also. They sniffed at the Fortress aircraft because its bomb-load was not equal to that of the Lancaster. But the Americans had their own theories and proceeded to prove their soundness.

It has yet to be proved whether even the Americans, with their vast resources, did not go to extremes in this matter, by which I mean putting more into strategic bombing than the rest of their economy could conveniently bear. There has been no statement from the American side comparable to that of Sir James Grigg in introducing the Army Estimates, when he estimated that heavy bombers alone were this year absorbing more of the nation's productive powers than the whole needs of the Army. It has been stated—though this can be only a rough estimate—that the bombing offensive has reduced the enemy's production by 25 per cent. Few people on hearing this apparently thought of asking whether it required more than 25 per cent. of our effort. I should imagine that it does, and the American proportion may be even higher. The extreme opponents of bombing, of whom I have never been one, would retort that if this was so the policy must be uneconomic, but a moment's reflection will show that they would be illogical. It might well be that we could afford a greater percentage than Germany in the present circumstances. There has never been any question that extremely valuable results are obtainable by strategic bombing, both by night and by day. The problem, like many others in war, is not as simple as that. It is, in short, not whether the bombing offensive pays, but whether we—and perhaps our Allies, too—should not have been wiser to draw from the total limited pool of men and women, material, and equipment a greater proportion for other weapons and other forms of attack.

The Americans came over here with some excellent aircraft of various kinds, but the two on which their offensives were founded were the Fortress and the Liberator. The former especially proved extremely effective and produced one of those tactical surprises which can be achieved only by weapons at once novel and of the highest class. It had great speed combined with vast range. It was armed with a veritable battery of heavy machine-guns, which produced a tremendous volume of fire. The hostile fighters, which had been wont when engaging bombers to stand off and attack with cannon fire while outside the effective range of the small-bore machine-guns of the quarry, received a rude shock. At a range about the same as their own they were met by a hail of large bullets which crumpled them up. Even a single bomber possessed powerful all-round defence, but by flying in a cleverly-planned formation, the Fortresses made themselves almost invulnerable. In their earlier missions they suffered hardly any losses, while destroying large numbers of the enemy. Their accuracy in bombing also enabled them to inflict a great deal of damage in proportion to their strength. It was all, in those early days, a mere flea-bite from the German point of view, but it suggested that when American strength grew the consequences for the enemy would be very serious.

However, the usual process came into play. Measures were taken to find the weaknesses of the new weapon. Themselves using new weapons and new tactics, the German fighters gradually gained ascendancy till a day came when they inflicted astonishing losses upon the bombers. It was nothing less than a defeat. But again the balance swung over, with a new triumph of American ingenuity and resource. The problem, hitherto appearing almost insuperable, had been that of finding a fighter approximately equal in speed and fighting power to the German short-range, single-seater fighters while possessing—with the aid of extra fuel tanks—range enough to accompany the bombers on all but the very longest of their missions. It seemed impossible, but it was done, and done so quickly that we have hardly noticed it. Only the other day we heard of fighters escorting the bombers to the limit of their short range and meeting them on their return, but leaving them to carry out the most difficult part of their mission unescorted. Now there are formidable American fighters which can go with bombers into Eastern Germany. The latter are now suffering heavier losses than they were in that blissful first stage which I have described, but not comparable to those which they had to endure in the bad period. The Germans themselves are suffering smaller losses than before, but that is largely because they have begun to avoid combat.

It is impossible to estimate with certainty the effects of the offensive, now carried out with forces many times as strong as those which fought the early battles. Communications in France, in times of peace among the best in the world, are not easy to interrupt, and can be relatively quickly repaired. If the Allies in Italy, where communications are sparse and the destruction of a single bridge may be a minor catastrophe, have not been able to prevent the Germans from supplying their front, it is doubtful whether they will be able to do so in France, even though the attack be on a vastly greater scale. They will certainly reduce the amount of goods carried by a certain percentage, but that might be anything between twenty and sixty, and he would be a bold man who would say to which figure it would approximate the more closely. Yet it may be, to consider only these two extremes, that twenty would stand for a German victory, whereas sixty would involve a complete German defeat. But it would appear that the offensive is meeting with a considerable measure of success, and it is highly significant that, as I have said, the Germans have frequently declined to fight. They have done this not because they have no power to fight, but because they lack the power to fight, and at the same time hold in hand an adequate reserve to meet even greater dangers. This attitude on their part is evidence of shortage and of weakness, even though, as we are well aware, they have still got something up their sleeves. It is like their situation as regards bombing last year: they had a fair number of bombers available, but could not afford to use them.

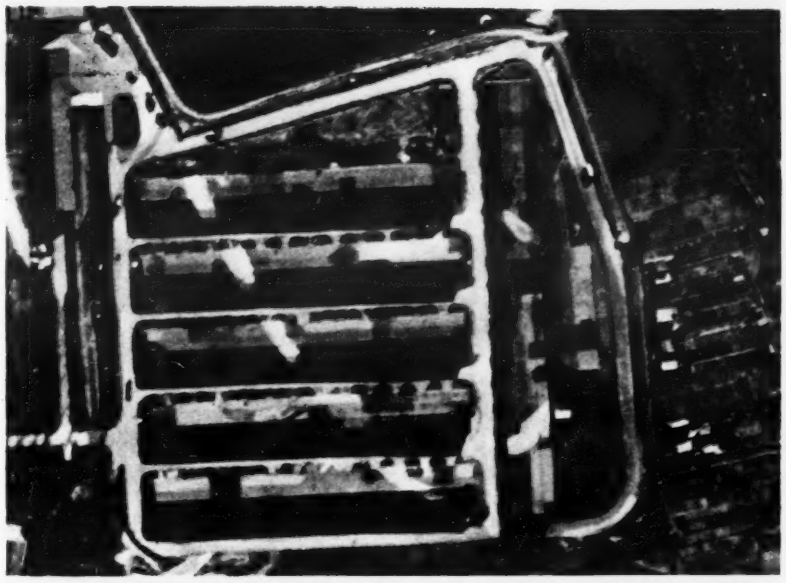
Meanwhile the night-bombing offensive has been continued by the R.A.F. Here, too, the Germans have made use of new weapons and tactics, but here, unfortunately, it has not been found possible to produce any support for the bomber such as was afforded to its American counterpart. As a result, the R.A.F. losses at one moment reached a very dangerous height, and it became evident that we could not go on accepting damage on that scale. Since then, night raiding deep in the heart of Germany appears to have become less regular. In some of the raids which have been carried out, extremely clever tactics have been employed to cheat the night-fighter force and prevent it from concentrating at the danger-point in time. One recent instance was seen on the night of April 26 when the main bomber force tricked the Germans into the belief that it was making for Hamburg, but suddenly turned upon Essen, while a force of Mosquitos did bomb Hamburg, and a secondary force of heavy bombers attacked Schweinfurt. In these operations the losses amounted to twenty-nine heavy bombers and two Mosquitos out of a force of over a thousand aircraft. But at the moment the day seems to be rather with the day-bombers, especially since short-term strategic objectives, such as communications, are now becoming more important than the long-term, such as arsenals.

Whatever our views as to the capital the Allies have sunk in their bombing offensive, two facts about it are now clear. First, they are committed to it in its present form; no change in the proportion of strength allotted to it in this year's campaigns can now be made. Secondly, the great strength in which it is being prosecuted has produced great effects, and these are likely to be exceeded, because that strength is growing almost daily, especially on the American side. The essential thing is that it should be fully co-ordinated with the other arms which will be employed in the new offensives. The school of Douhet is no longer practical policy. It is only by the use of all arms in concert, by using all arms as one, that victory can be achieved.

THE U.S. DAYLIGHT 1500-'PLANE RAID ON BERLIN: THE CENTRE OF THE CAPITAL FROM TEMPELHOF AIRPORT TO THE AIR MINISTRY AND UNTER DEN LINDEN, AFTER ATTACKS BY THREE CONCENTRATIONS OF FORTRESSES AND LIBERATORS.

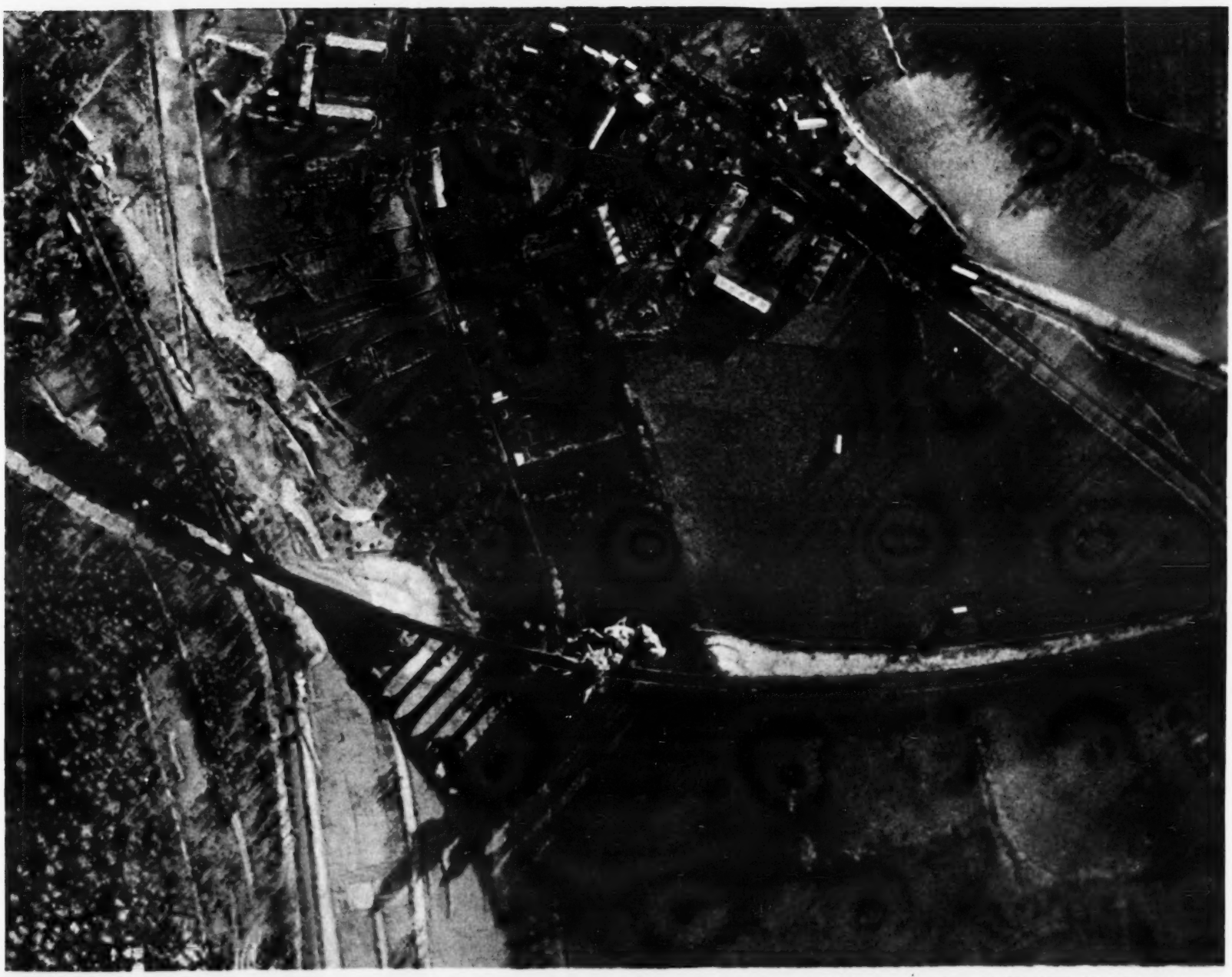
Weeks ago it was stated by neutral observers that only 25 per cent. of Berlin was standing. In daylight on Saturday, April 29, the U.S. Eighth Army Air Force, with a gigantic formation of 1500 'planes, delivered another crippling blow on the capital, its main target being the Luftwaffe Headquarters in the heart of the city. Our photograph shows a Flying Fortress above Tempelhof Airfield, partly obscured in black smoke; Anhalter Station, with bombs bursting in vicinity; the Air Ministry, where three concentrations burst, with its south wing burning fiercely; and Unter den Linden, below the Air Ministry ablaze.

DAY AND NIGHT PRECISION BOMBING: TWO TARGETS SQUARELY HIT.



A LUFTWAFFE SIGNALS EQUIPMENT DEPÔT AT ST. CYR, NEAR VERSAILLES, BEFORE IT WAS VISITED BY LANCASTERS OF R.A.F. BOMBER COMMAND. . . .

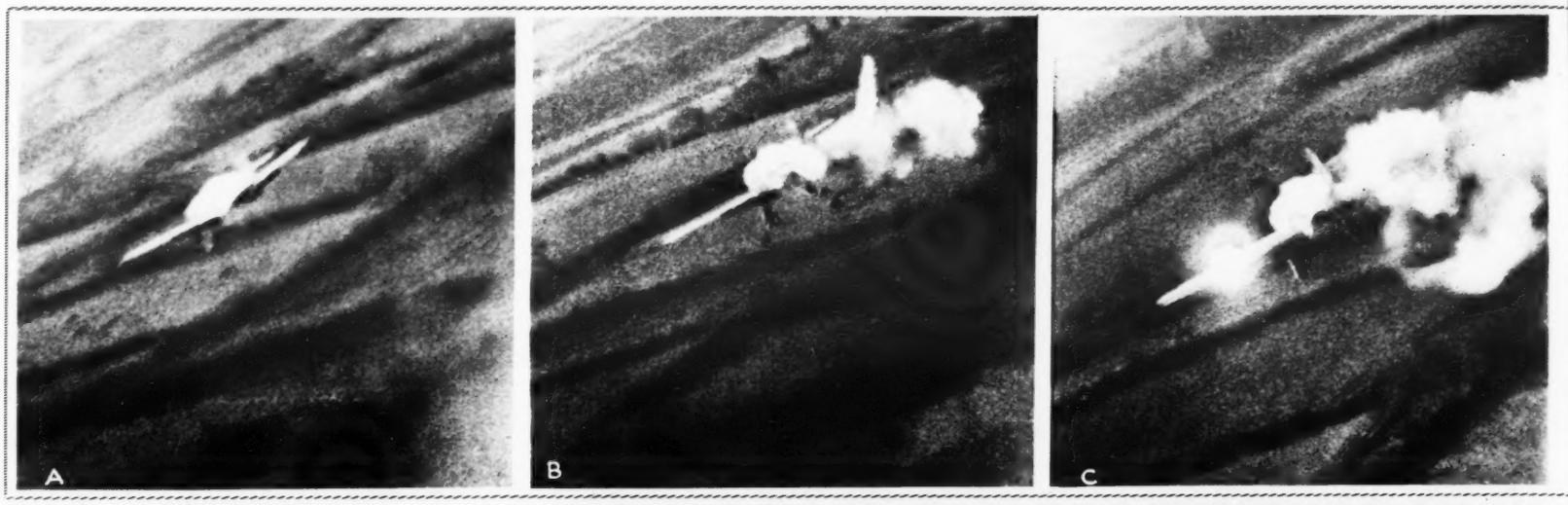
. . . AND THE SAME TARGET AFTER PRECISION BOMBING BY THE LANCASTERS ON THE NIGHT OF APRIL 10. THE DEPÔT HAS BEEN VIRTUALLY OBLITERATED.



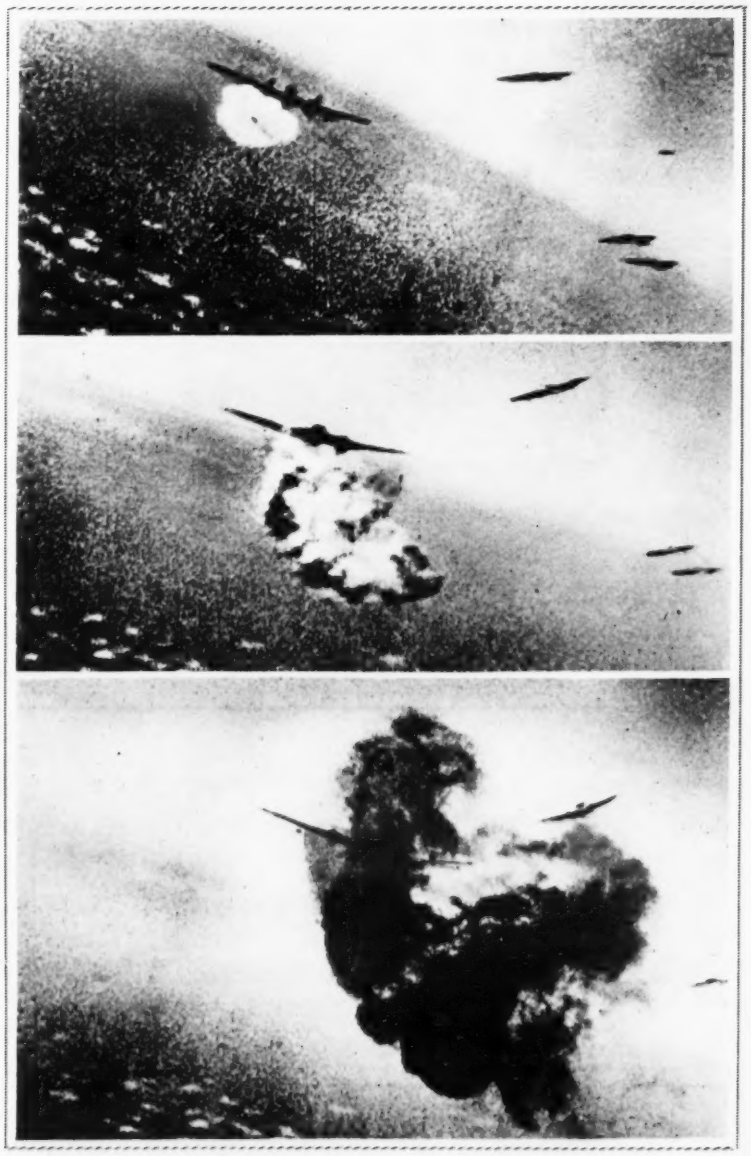
AN EXAMPLE OF PRECISION DAYLIGHT BOMBING BY BOMBERS OF THE U.S. ARMY AIR FORCES. A BOMB BURSTS SQUARELY ON A HIGH VIADUCT NORTH OF POIX, FRANCE, IN THE PATH OF A TRAIN SEEN BEARING DOWN ON THE VIADUCT FROM THE LEFT.

It has been commonly supposed that whereas the daylight bombers of the U.S. Army Air Forces have concentrated on precision bombing of individual targets, R.A.F. Bomber Command has relied on area bombing for the effectiveness of its night raids. In fact, Bomber Command has brought night precision bombing to a fine art, as has been exemplified by recent news of attacks on specific plants, in which the new "factory-buster" bombs have been used with deadly effect. Our first two pictures show an example of this precision bombing by night—the virtual obliteration in one attack of a depôt reported to contain large stores of signals and radiolocation equipment for the use of the Luftwaffe. The Lancasters which made the attack were carrying 8000-lb. bombs. The third picture is an outstanding example of daylight precision bombing, a difficult target having been squarely hit by an American bomber. The bomb is exploding on one span of a high viaduct, in the path of a train approaching from the left—a combination of circumstances which inspired a U.S. Army Air Forces officer to write a caption in verse, ending with the lines: "You can have good brakes and lots of traction, But a train can't take evasive action!" Certainly not in the present case!

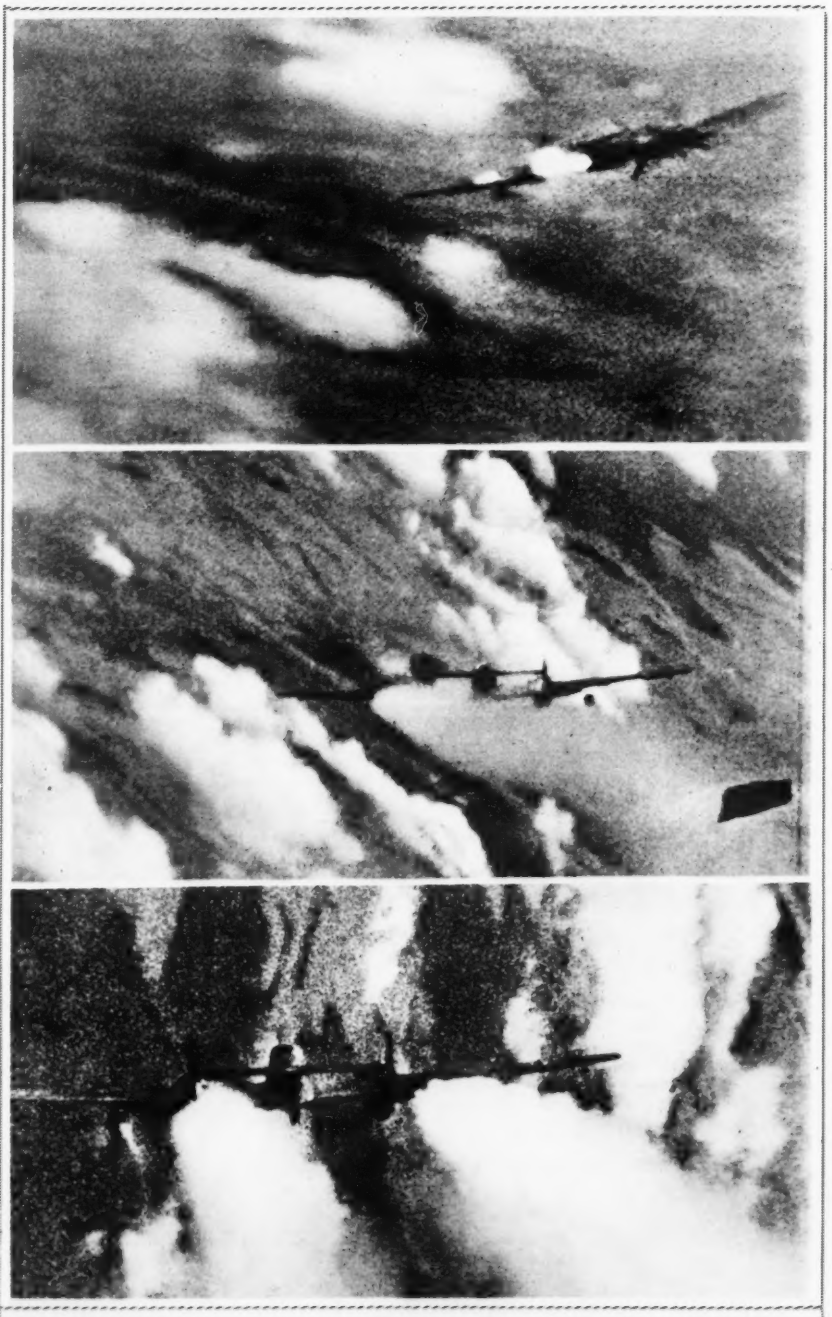
ALLIED BOMBER ESCORTS REGISTER KILLS: DOCUMENTARY



THE DEATH OF A ME.109G. AS IT TOOK OFF FROM ITS AIRFIELD IN NORTHERN FRANCE (A), IT WAS SPOTTED BY OUR



THREE STAGES IN THE DEATH OF A TWIN-ENGINE GERMAN FIGHTER, DESTROYED BY AN AMERICAN COMBAT 'PLANE ESCORTING THE U.S. BOMBERS SEEN TO THE RIGHT.



THE LAST MOMENTS OF A ME.110, HIT BY A U.S. FIGHTER (TOP), A PIECE FLEW OUT OF THE ENEMY 'PLANE (CENTRE), WHICH PLUNGED INTO FLAMES (BOTTOM).

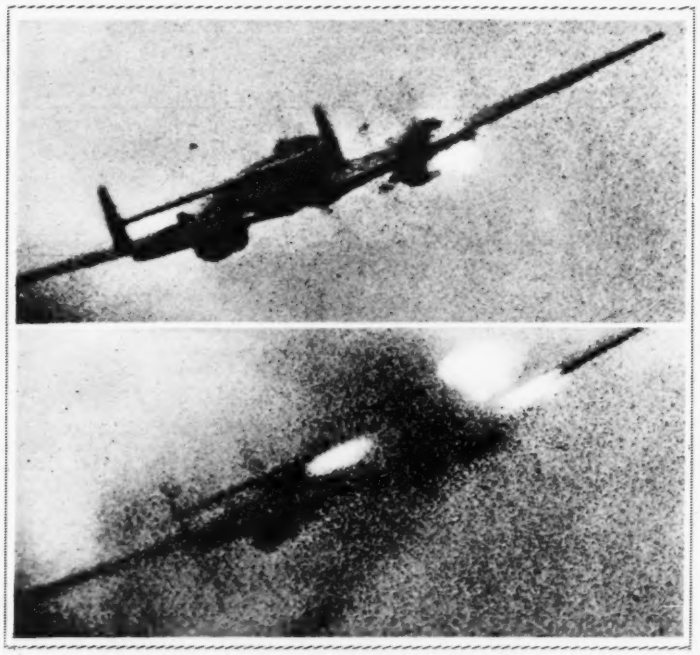
ALLIED BOMBING STATISTICS FOR THE MONTH OF MARCH 1944.

DURING MARCH, STRATEGIC BOMBING AT NIGHT BY THE ROYAL AIR FORCE WAS THE HEAVIEST YET DEVELOPED. ON GERMANY AND ENEMY-OCCUPIED TERRITORY THE R.A.F. DISCHARGED BOMBS WEIGHING APPROXIMATELY	28,000 tons
R.A.F. AIRCRAFT SENT ON NIGHT-BOMBING MISSIONS	More than 8000
R.A.F. AIRCRAFT LOST OVER EUROPE	351
THE U.S. STRATEGIC AIR FORCES IN DAYLIGHT, DURING MARCH, DROPPED ON WAR INDUSTRIES AND OTHER VITAL ELEMENTS OF THE GERMAN WAR MACHINE A BOMB-WEIGHT OF	27,430 tons
ENEMY AIRCRAFT DESTROYED BY U.S. BOMBERS AND THEIR ESCORTS ..	1061
U.S. BOMBERS LOST	369
U.S. FIGHTERS LOST	178
TOTAL WEIGHT OF ALLIED BOMBS DROPPED, MARCH 1—31	55,430 tons

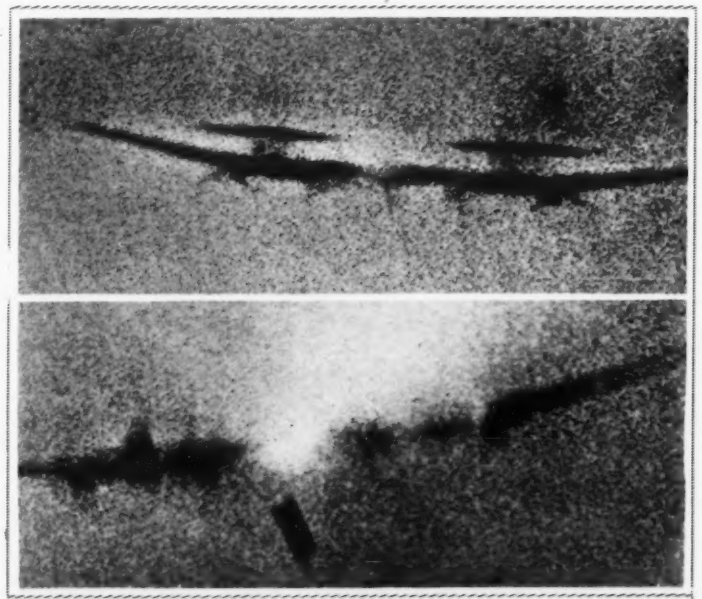
THE intensification of the air war over Europe in the last few months has meant not only the unloading of ever-increasing tonnages of bombs on vital enemy targets, but a growing rate of destruction in the ranks of the Luftwaffe. Comparative figures of the weight of bombs dropped, the targets hit, and the number of enemy aircraft destroyed are given in the tabulated panels on the left and right. The left-hand panel shows the combined details of the Allied day-and-night offensive during the month of March, 1944; the panel on the right deals with the steadily—and now rapidly—increasing tonnage of bombs dropped on Germany and enemy-occupied territory by Bomber Command of the R.A.F. from 1940 to March 1944. The accompanying pictures, taken by automatic cameras synchronised with our guns, illustrate the ways

PROOF OF DESTRUCTION OF ENEMY AIRCRAFT IN BATTLE.

TYPHOONS, WHICH HIT IT HARD WITH CANNON-FIRE (B AND C), CAUSING IT TO DIVE IN FLAMES (D, E, F) AND EXPLODE.



ANOTHER VICTIM OF R.A.F. TYPHOONS, A ME.110 WHICH, HIT IN THE COCKPIT AND STARBOARD ENGINE, PLUNGED INTO THE SEA NEAR DUNKIRK.



THE END OF A "FLYING MONSTROSITY"—THE FREAK GERMAN DOUBLE-HEINKEL, RECENTLY SHOT DOWN OVER FRANCE BY TWO MOSQUITO PILOTS.

in which enemy 'planes meet their ends when opposing Allied bombing and other missions over Europe. The terrific fire-power of R.A.F. and U.S. Army Air Force fighters of the present day often causes an enemy aircraft to disintegrate in mid-air, at least one example of this being shown in a picture on the right, in which pieces of the German 'plane are seen flying in all directions. The respect shown to this Allied fire-power is reflected in the reluctance of the Luftwaffe to send up fighters in strength to meet the escorts which accompany our bombers over the Continent. Whenever they do so, their losses, at least in daylight, are out of all proportion to the damage they inflict. The Allied air forces are, indeed, well on the way to complete control of the air over Europe.

HIT BY A FIGHTER OF THE U.S. EIGHTH AIR FORCE, THIS ME.109 DISAPPEARED TRAILING A PLUME OF SMOKE, BUT NOT BEFORE THE AUTOMATIC CAMERA HAD REGISTERED THE SCORE.

A GERMAN FIGHTER 'PLANE BEGINS TO DISINTEGRATE IN MID-AIR AFTER BEING CAUGHT BY THE GUNS AND CAMERA OF A U.S. AIRCRAFT OVER EUROPE.

BOMBS DROPPED ON GERMANY AND ENEMY-OCCUPIED TERRITORY BY ROYAL AIR FORCE BOMBER COMMAND, 1940 TO MARCH 1944.

1940	12,795 tons	1944:	
1941	31,185 tons	January	18,000 tons
1942	42,285 tons	February	13,300 tons
1943	157,160 tons	March	28,000 tons

TOTAL TO MARCH 1944 .. 302,725 tons.

MAJOR AIR ATTACKS* ON TOWNS IN GERMANY AND OCCUPIED EUROPE CARRIED OUT BY ROYAL AIR FORCE BOMBER COMMAND SINCE THE OUTBREAK OF WAR IN 1939 UP TO MARCH 31, 1944:

Berlin (22 attacks); Cologne and Essen (8); Hamburg, Duisburg, Mannheim-Ludwigshaven, Stuttgart (6); Dusseldorf, Nuremberg, Frankfurt (5); Hanover (4); Munich, Bochum, Kassel, Leipzig (3); Bremen, Dortmund, Gelsenkirchen, Kiel, Stettin, Le Mans, Amiens (2); Saarbruecken, Wilhelmshaven, Krefeld, Mulheim, Barmen, Elberfeld, Aachen, Munchen-Gladbach, Peenemunde, Hagen, Modane, Brunswick, Magdeburg, Schweinfurt, Augsburg, Trappes, Aulnoye (1).

**The weight of bombs in these attacks ranges from 500 tons to more than 2500 tons.*

FAMOUS AIRCRAFT: No. 20—THE B-26 MARAUDER, A FOR

PAINTED BY OUR SPECIAL ARTIST, C. E. TURNER, FROM SKETCHES MADE

U.S. AIR FORCE MARAUDERS RUN INTO HEAVY FLAK OVER EUROPE ON EMERGING FROM CLOUD COVER. THE

The U.S. Marauder, the B-26, is a two-engined medium bomber which has the distinction of being the first U.S. airplane designed during this war to see active service. The suddenness of war emergency prevented the usual design and construction of an experimental machine prior to quantity production, but the wealth of experience at the command of the U.S. Army Air Forces, the R.A.F., and the Glenn L. Martin Company was drawn upon to produce a superior design, and thereby a delay of at least twelve months was avoided. The requirement that the Marauder should be faster than previous bombers was achieved primarily by exceptionally clean aerodynamic design. The cigar-shaped fuselage is a pure streamline form almost without interruption, and the airplane is fitted with twin Pratt and Whitney engines, each developing 2000 h.p. giving a speed of about 300 m.p.h. The load-carrying ability and performance

A FORMIDABLE MEDIUM BOMBER AND TORPEDO CARRIER.

SKETCHES MADE AT A U.S. AIRFIELD BY COURTESY OF U.S. BOMBER COMMAND.

OVER. THESE 300-M.P.H. AIRCRAFT CARRY TWELVE HALF-INCH MACHINE-GUNS AND A BOMB LOAD OF 4000 LBS.

had to be accompanied by high-wing loading and relatively high landing-speed. The most important feature in this respect is the tricycle landing-gear, which provides easy handling at high speed and eliminates the possibility of nosing over. Marauders have been very prominent in many battle-fronts, including Alaska, the Battle of Midway, and in Tunisia, and by no means least, to-day on the Western Front, for medium-altitude bombing and as torpedo-bombers at low level. These high-wing aircraft are depicted crossing the coast of France and encountering heavy flak as they emerge from protective cloud. A typical Marauder "stepped-up six" formation is seen, the other five in the background leaving vapour trails. The Marauder's 12 half-inch machine-guns provide formidable defensive fire-power, and she can carry a bomb load of 4000 lbs. The painting is based on sketches made at a U.S. airfield visited by our artist.

WELDING THE FORCES OF INVASION:

THE WORK OF THE ROYAL CORPS OF SIGNALS, WHO ARE RESPONSIBLE FOR COMMUNICATIONS—THE VITAL CO-ORDINATING LINK.

IF the secret of successful invasion of the Continent were to be expressed in one word, perhaps that word would be "Co-ordination"—co-ordination of the sea, land and air forces of all the Allies; close co-ordination of the various arms of the land forces; and, above all, complete co-ordination, amounting to integration, of ground and air attack. Everyone knows that this was the great lesson of the battles and landings in the Mediterranean. What the public does not realise is the extent to which this co-ordination is dependent on a branch of the Army which still remains something of a mystery to most people—the Signals.

Fortunately, the Army has learned to respect its communications. "If there are no Signals, there is no Corps," a famous Corps Commander said to his staff recently. The Royal Signals have reorganised to meet the new and increased demands upon them, and they are equipped and tuned up for the great battles to come. At the various Allied Headquarters, the Royal Signals and the U.S. Signal Corps work side by side and have evolved common procedures and phraseology.

Signal officers of high rank of both nations are on General Eisenhower's staff at Supreme Headquarters, Allied Expeditionary Force. The Chief Signal Officer (C.S.O., for short) happens to be British. He is a Major-General. He has a staff of specialists, including a Chief Air Formation Signals Officer, who will be responsible for the telephone and telegraph communications of the Allied Air Forces when established on the Continent. General Montgomery also has a highly qualified Signal staff and a Chief Signal Officer with the rank of Major-General. Helping him are wireless experts, line experts, railway signal experts, and so on.

In the early stages, the success of the invasion will depend on wireless. Beach signal units, consisting of Royal Navy and Royal Signals personnel will land with the first assault troops and establish signal stations on or near the beach, digging themselves in for protection against enemy fire from ground or air. Their job will be to keep in touch by wireless with the troops advancing inland and with the brigade and divisional commanders who at that stage will still be afloat. They will also provide communication between the Beach Master and the craft lying off-shore or approaching the beaches. Our war artist depicts a scene such as this on pages 518-519. They will have to establish this elaborate inter-Service wireless telephone system at a time when communications are most essential and yet most difficult to provide. They will need the best possible equipment. They will take it ashore in specially-designed wireless hand-carts—rather like enlarged perambulators—the equipment being protected from immersion and splashing by waterproof covers.

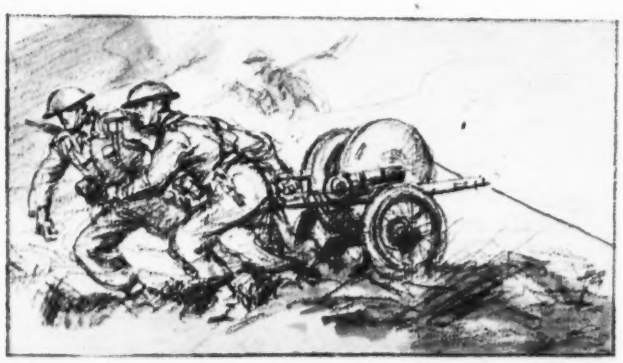
For over three years signal officers of the Royal Navy, the Army, and the Royal Air Force have been studying, revising and practising the complex and still secret lay-out of signal communications which are necessary for these hazardous invasion operations.

"Slick" communications are vital enough in land operations. The movements of a complex Army—reconnaissance units, infantry, tanks, guns, sappers and the recovery and supply services—have all to be made to fit in with one another. Minute-by-minute information must flow back. The Army Commander and his Staff must exercise constant control or the complex, interdependent forces available would get in one another's way.

If this is so in land operations, how much more necessary is it in combined operations when the Navy lands the Army under R.A.F. cover on a hostile shore; when no one knows the degree of opposition which will be met; when the Commander of an assaulting brigade or division cannot see for himself what is happening and yet has to exercise control; and when every time-table for landing infantry, tanks, guns, and supplies must be capable of instant adjustment according to how the battle goes.

The British Army's signal communications have been very severely tested and extended in the present war. The mobility and speed of modern warfare and the vast distances over which it is being waged have made it necessary to provide wireless communication on a scale not hitherto contemplated. In the field, for instance, wireless communications have been provided not only for every headquarters and every fighting unit down to the infantry platoon, the tank, and the armoured car; they have also been provided for the tank-recovery units, the sappers, and for the medical and supply services. Special communications networks have been established also for the control of air support for the Army, for initiating reconnaissance from the air and for disseminating reports of air reconnaissance. Every major development in the tactical handling of an arm of the service has tended to increase the scale of signal communications.

IN THE INITIAL STAGES OF INVASION, ROYAL SIGNALS DETACHMENTS CARRY COMPLETE WIRELESS STATIONS IN SPECIALLY DESIGNED HAND-CARTS, SOMETHING LIKE OUTSIZE PERAMBULATORS, PROTECTED FROM SEA-WATER BY SPECIAL COVERINGS.



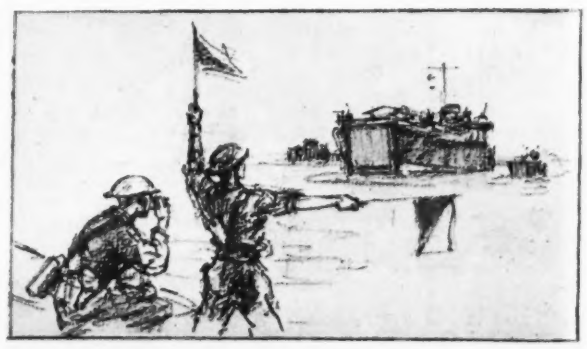
IN CASES WHERE WIRELESS MIGHT BETRAY OUR MOVEMENTS, CABLE COMMUNICATION IS PREFERABLE. LINE-MEN ADVANCE WITH THE MINE-CLEARERS, USING CABLE-DRUM HAND-BARROWS.

Another problem has been that since 1940 the theatres of war have never been less than a thousand miles—and some several thousand miles—from the Home country, and armies have operated a thousand miles and more from their bases in those theatres. Civil systems of communication either have not existed or have been unreliable or totally inadequate. The Army, therefore, has had to create, operate and maintain its own world-wide wireless chain as well as a network of line telegraph and telephone communications not incomparable with the large international systems. Highly technical equipment not previously handled by the Army has had to be used for these purposes, and men who before the war had no technical knowledge have had to be trained to took after it.

For communication with the Middle East and India, Britain used to rely chiefly on the submarine cables through the Mediterranean. As soon as the Italians entered the war, they cut the cables and laid minefields over the breaks. From that time until recently, when the Allies regained control of the Mediterranean, communication between the War Office in London and General Headquarters in the Middle East and India was almost entirely by the Army's wireless system. It was by wireless chiefly that all arrangements were made for building up the armies which were to protect the supply routes to India and Russia and eventually to drive westwards from El Alamein to Tunisia. The average daily traffic on the London-to-Cairo Army wireless link alone amounted to 80,000 words—the length of a novel. The Allied landings in North Africa made it necessary to rely on wireless communication there also, for there was no adequate ready-made civil system, and it was not long before the line communications between Allied headquarters and divisions in the field extended to over 500 miles. It can be imagined that this presented considerable difficulties to a force which had been landed with necessarily the minimum amount of equipment.

The whole of the British Army's signal communications, as well as the line communications of the Royal Navy and the Royal Air Force when away from Britain, are the responsibility of the Royal Corps of Signals, a combatant corps which was formed in 1920 to specialise in and develop communications work which had been started by the Royal Engineers.

The organisation of the Royal Signals is briefly as follows: all men in the Corps, although armed and trained to fight, are also trained to an Army "trade," the chief trades being those of operator, electrician, instrument mechanic, lineman, despatch rider and driver. For every headquarters in the Army, from the War Office down to divisions in the field, there is a signal unit, commanded by a lieutenant-colonel, with enough men of the appropriate trades and enough equipment to provide the wireless, telegraph, telephone and messenger services from that headquarters to the formations or units under its command or co-operating with it. (Messenger services include air courier, despatch-rider and pigeon.) Thus, a unit known as War Office Signals operates the communications from the U.K. to the headquarters of commands at home and abroad. Each General Headquarters has a unit to provide communications thence to the armies in the field, to the Royal Navy in its various ports, to the Royal Air Force and to civil authorities. Similarly, there are appropriate units at each Army and Corps Headquarters, the communications becoming less static and the equipment more mobile with each step down the chain of command. The divisional signals unit, whether serving an infantry or an armoured division, is highly mobile. It consists of over 700 men—almost three times the size of the corresponding unit at the end of the 1914-18 war—and the number of its vehicles approaches 200. It is organised into companies and sections (or squadrons and troops in an armoured division), each with a particular rôle. There is an administrative section; a maintenance section for maintenance and first-line repairs of all signal equipment in the division; wireless sections; despatch-rider section; and a cable section for laying the lines which are still used whenever possible, because they can carry more traffic than wireless, with less risk of interception by the enemy.

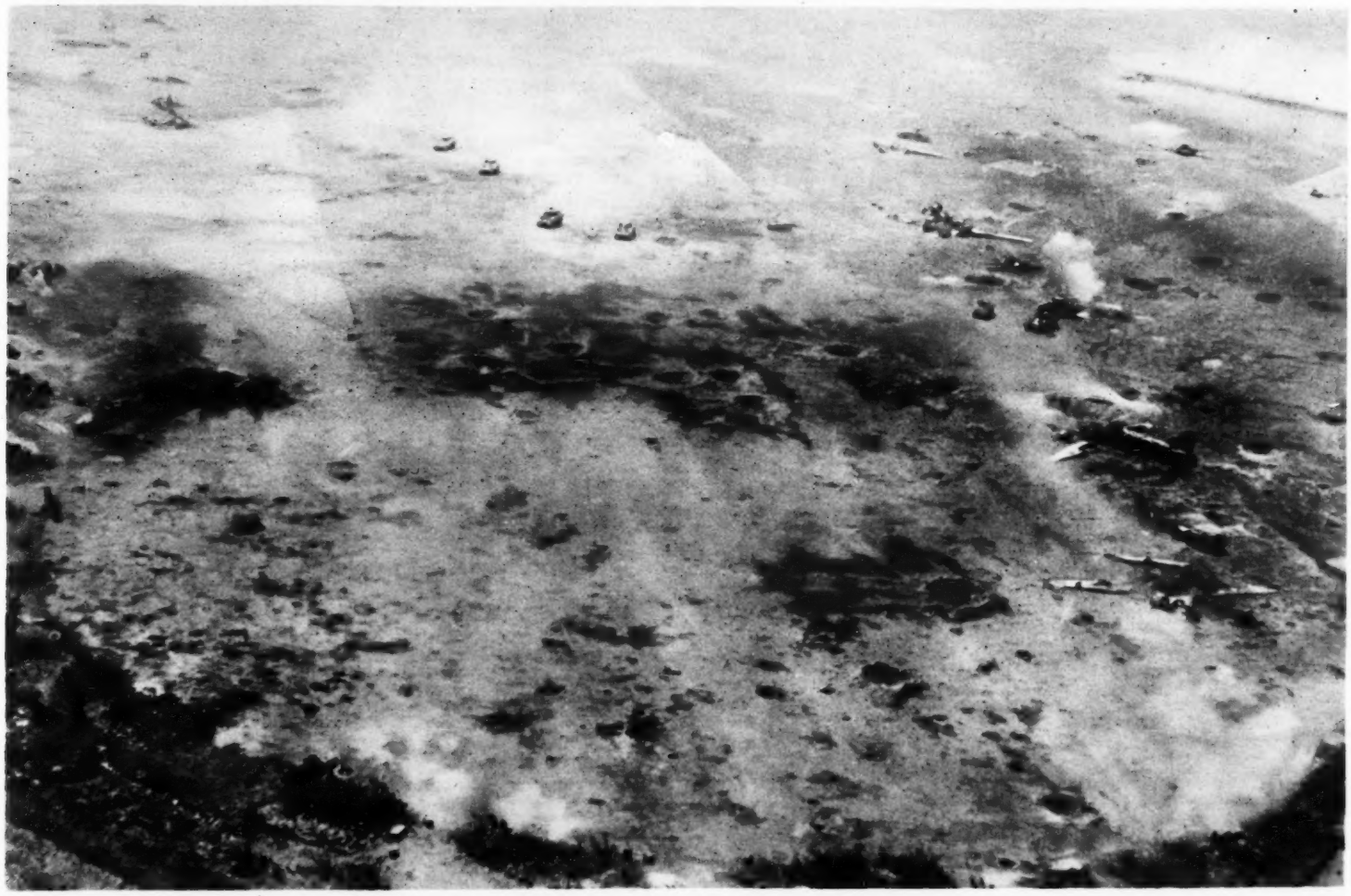


WHERE COMMUNICATIONS ARE BETWEEN DETACHMENTS VISIBLE TO ONE ANOTHER, SUCH AS BETWEEN BEACH AND LANDING CRAFT, SEMAPHORE IS SOMETIMES USED.

A separate self-contained section, consisting of operators, linemen, maintenance personnel, despatch-riders and drivers, is also detached and sent under the command of an officer to the headquarters of each brigade and artillery regiment in the division, the rôle of each such section being to provide communication from the headquarters to which it is attached forward to the battalions, armoured regiments or batteries, as the case may be. Within those battalions and other units the signal communications are operated by the regimental signallers belonging to the unit and not by the Royal Signals.

Signal equipment in the Army ranges from the lineman's portable telephone and the infantryman's pack wireless set to the 200-line telephone switchboard at Army Headquarters and the "Golden Arrow," the high-power mobile wireless station capable of communicating halfway round the world at 150 words a minute, or seven times the speed of an operator working by hand with a Morse key.

BATTLE SCENES—FROM THE AIR AND FROM THE GROUND.



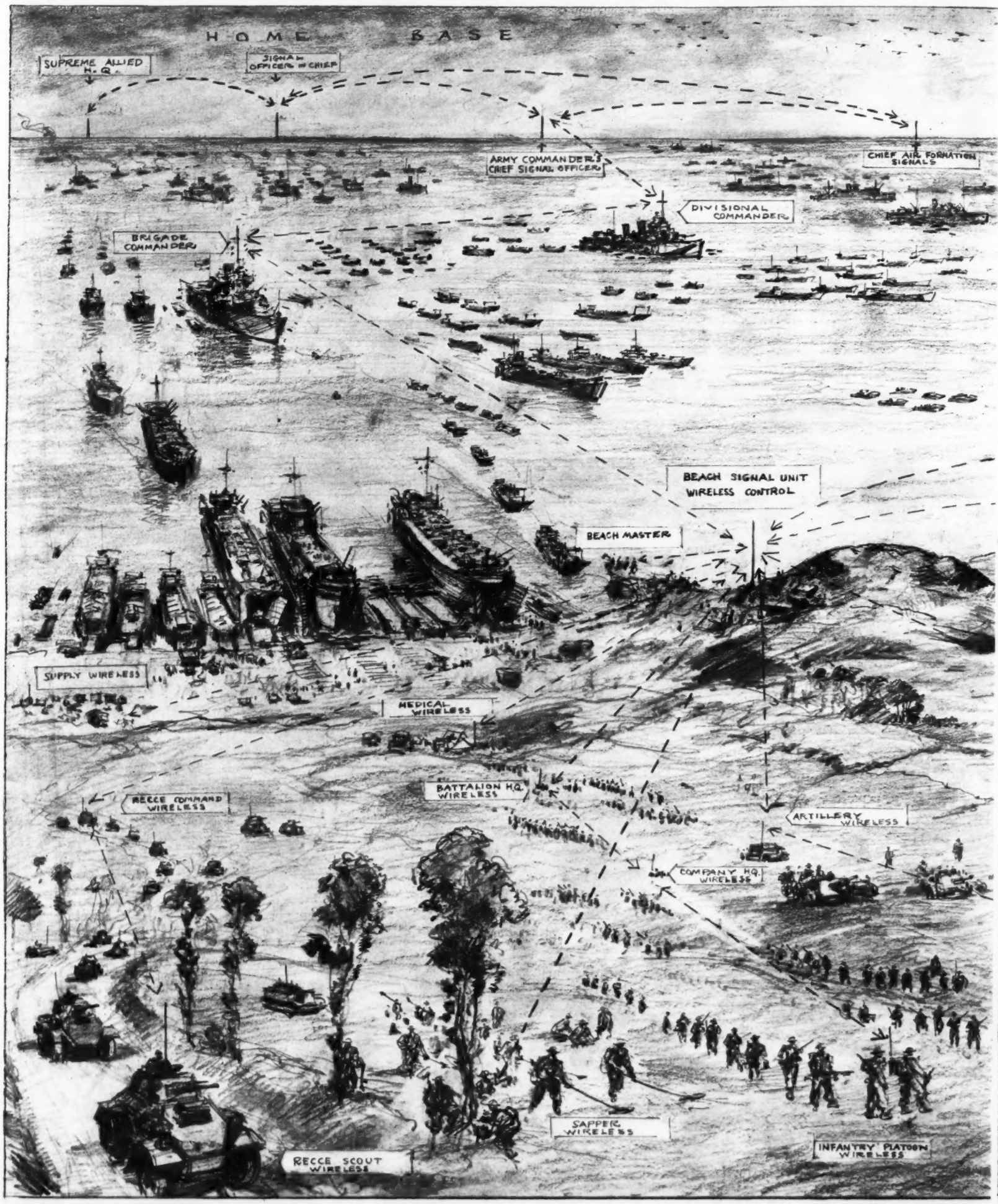
AS SEEN FROM THE AIR: A BATTLE IN WHICH U.S. TANKS WERE ENGAGED. THE PHOTOGRAPH SHOWS THE LAST STAND MADE BY THE JAPANESE ON KWAJALEIN, IN THE MARSHALL ISLANDS. NOTE THE AMERICAN TANKS ADVANCING AND THE SHATTERED ENEMY AIRCRAFT.

AS SEEN FROM THE GROUND: A "BATTLE" IN WHICH M4 TANKS GO INTO ACTION WITH U.S. INFANTRYMEN DURING AN EXERCISE. THESE TANKS ARE NOW EQUIPPED WITH 50-CALIBRE A.-A. MACHINE-GUNS, GIVING THE INFANTRY PROTECTION FROM THE AIR AND FROM THE GROUND.

These photographs give two angles on modern warfare: the aerial and the ground. In both, tanks are being used; at Kwajalein, in the Marshalls, they are about to overrun the last Japanese-held positions, and in the lower picture the tanks are giving cover to the advancing infantry. The first is a battle scene of the past, for U.S. forces seized Kwajalein early in February, but the second is in preparation for battles to come when Allied forces set out to liberate Europe. The tanks shown are M4s, now equipped with 50-calibre anti-aircraft machine-guns, which give excellent protection from air and ground.

THE INITIAL STAGES OF AN INVASION: WIRELESS AS THE CO

Drawn by our War Artist, Captain Bryan de Grineau, WITH



A SYMBOLICAL LAY-OUT OF AN AMPHIBIOUS INVASION: THE NETWORK OF COMMUNICATIONS

Complete co-ordination of attack by land, sea, and air forces is the great lesson learned in the amphibious operations in the Mediterranean—a lesson that is to be acted upon in the invasion of the Continent. To a very great extent such co-ordination is dependent on the Royal Corps of Signals, who, with their American counterpart, the U.S. Signal Corps, are fully tuned up for the great battles to come. Signal officers of high rank of both nations are on General Eisenhower's staff at the Supreme Headquarters of the Allied Expeditionary Force, for in its early stages the success of the invasion depends on wireless intercommunication among the many Service units involved on sea and land and in the air. In these early stages—of which our artist's drawing is a symbolical lay-out—beach signal units land with the first assault troops and establish signal stations on or near the beach,

WH

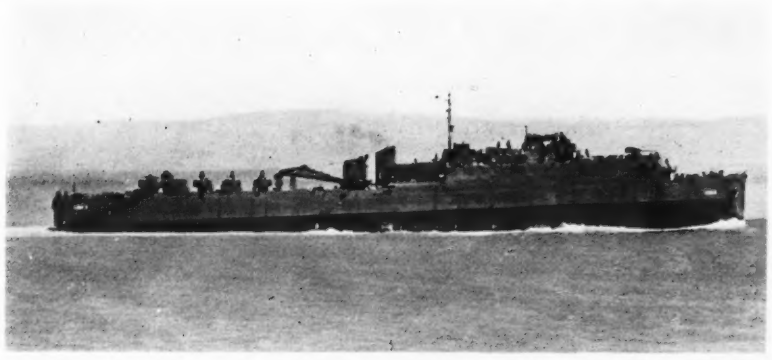
CO-ORDINATING LINK BETWEEN LAND, SEA, AND AIR FORCES.

WITH THE CO-OPERATION OF THE ROYAL CORPS OF SIGNALS.

WHICH WELDS THE VARIOUS FORCES INTO ONE CO-ORDINATED WEAPON OF ASSAULT.

digging themselves in as soon as they set foot on shore. Their job is to keep in touch by wireless with the troops advancing inland, and with the brigade and divisional commanders who, at that stage, would still be afloat; and to provide communication between the Beach Master and the craft lying off-shore or approaching the beaches. To establish this elaborate inter-Service wireless telephone system under such hazardous conditions, signal officers of the Royal Navy, the Army and the R.A.F. have been revising and rehearsing a complex secret lay-out for more than three years. The equipment which they take ashore in specially designed wireless hand-carts is the means by which commanders who cannot see what is happening will nevertheless be able to maintain control of the widely diverse forces fighting in collaboration to establish a beach-head for further operations.

CAMERA RECORDS INTERESTING FACTS: NEWS ITEMS AT HOME AND ABROAD.



ONE OF THE LARGEST VESSELS IN THE UNITED STATES NAVY'S FAST-GROWING LANDING CRAFT FLEET: THE L.S.D. (LANDING SHIP, DOCK). IT IS AN OCEAN-GOING CRAFT OF SOME CONSIDERABLE SIZE.

THE LARGEST MOBILE GUN USED BY THE U.S. ARMY ON THE ITALIAN FRONT: A 240-MM. HOWITZER, SHOWN BEING PULLED INTO POSITION ACROSS A ROUGH PIECE OF TERRAIN.

VESUVIUS CHANGES HER SHAPE: THE OLD SUMMIT OF THE VOLCANO CRUMBLED AWAY DURING THE RECENT ERUPTION AND THE CRATER TOOK ON ANOTHER FORM.

The above picture was taken by an R.A.F. photographer from an aircraft flying low over Mount Vesuvius, and it shows the changed shape of the crater after the recent serious eruption, which did considerable damage over a wide area. All of the old summit of this famous volcano crumbled away in the streams of red-hot lava which flowed down the slopes, engulfing villages and killing all vegetation in their path.

A NEW TYPE OF NAZI MINE; IT CONSISTS OF A WOODEN BOX, IN WHICH IS PLACED A HALF-POUND BLOCK OF TNT.

The Nazi practice of laying mines to impede Allied advances in Italy is well known, and among the various types of mines used is the wooden box-mine shown above. In it is placed ½-lb. of TNT., and a detonator is passed through a hole in the front of the box. The lid is prevented from closing properly by a small twig, which, when displaced, allows the box to close, thus knocking out the pin and firing the detonator.

YET ANOTHER HITLER-MUSSOLINI MEETING, BUT THIS TIME THERE IS ONLY ONE DICTATOR. MUSSOLINI IS REPORTED TO BE SERIOUSLY ILL.

Hitler and Mussolini have met once more, presumably to discuss the coming Allied invasion of Europe, but Mussolini—reported to be a dying man—is no longer of any importance, even to Hitler, for his rule is finished in Italy, and the few Italians who still support him hardly count in the general scheme of things. Mussolini is a shadow of his former self, his cheeks have fallen in and his new uniform hangs loosely on him. Although he summons a smile for Hitler, he has the air of a condemned man.

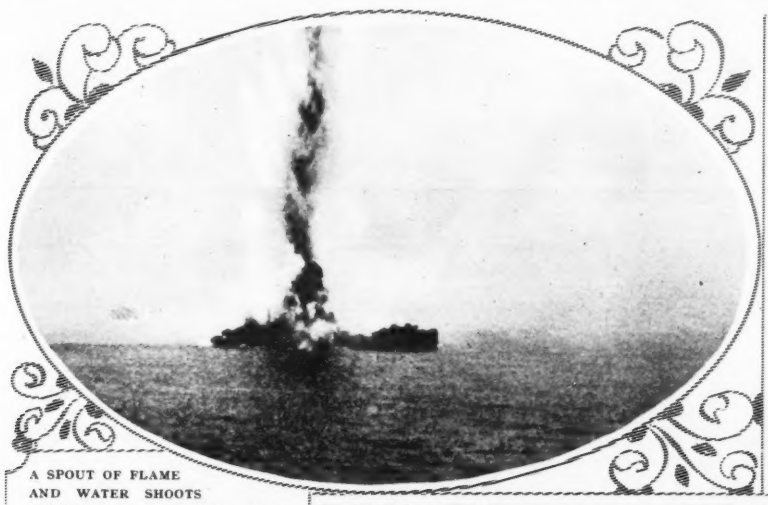
GENERAL MONTGOMERY'S VICTORY CARAVAN IN LONDON: DRIVER WOODS, WHO DROVE THE GENERAL FROM EL ALAMEIN TO TUNIS, ACTS AS GUIDE.

The two caravans from which General Sir Bernard Montgomery led the Eighth Army campaigns in North Africa and Sicily are on view at the "Daily Telegraph" "Prisoners of War" Exhibition now open at Clarence House. They were captured from the Italian Generals Berganzoli and Messe, and General Montgomery has lent them to the Duke of Gloucester's Red Cross and St. John Fund, in conjunction with which the Exhibition has been organised.

THE KING INSPECTS HIS INVASION TROOPS: HIS MAJESTY STOPS FOR A CHAT WITH A R.E.M.E. PRIVATE ATTACHED TO AN ARMOURED BRIGADE.

The King spent another day with his invasion troops on April 27, his second visit to the invasion forces in Britain in three days. This time it was British units his Majesty visited, and it was a day mainly of ceremonial parades and inspections. At several places he walked slowly round ranks of troops formed up in hollow squares, speaking to many of them. An unusual feature was that headquarter troops of the various formations were paraded as "spectators" at many points.

R.A.F. BEAUFIGHTERS SINK AND CRIPPLE ENEMY ESCORT SHIPS OFF HOLLAND.



A SPOUT OF FLAME AND WATER SHOOTS UPWARDS AS A COASTAL COMMAND BEAUFIGHTER'S TORPEDO CRASHES HOME ON AN ENEMY ESCORT VESSEL ATTACKED NEAR THE FRISIAN ISLANDS.

THE ESCORT VESSEL, ONE OF FOUR ATTACKED BY A GROUP OF BEAUFIGHTERS, GIVES OUT DENSE CLOUDS OF SMOKE BEFORE BLOWING UP AND SINKING.

ALMOST daily comes news of Coastal Command's unceasing warfare on enemy shipping off the coasts of Europe, with frequent sinkings of enemy merchant vessels and the armed ships escorting them. In this type of warfare the Beaufighters, armed with torpedoes and powerful cannon, have proved pre-eminently successful. Our pictures were taken during a recent attack by a group of Beaufighters on enemy shipping near the Frisian Islands, off the Dutch coast. During the attack, one large-sized escort vessel was torpedoed, and subsequently blew up and sank, and three other escort ships, heavily smothered by cannon-fire, were severely damaged. By the time the Beaufighters eventually left the scene of the action, the escort was broken up and completely disorganised.

(ABOVE.) OTHER ENEMY ESCORT VESSELS ALMOST DISAPPEAR FROM VIEW UNDER THE FURIOUS CANNON FIRE OF THE ATTACKING BEAUFIGHTERS. THREE OF THE SHIPS WERE CRIPPLED BY THE ASSAULT.

(LEFT.) FOLLOWING THE CANNON-FIRE ATTACK, A VAST EXPLOSION THROWS OUT STREAKS OF FIRE FROM AN ARMED TRAWLER, WHICH WAS LEFT ENVELOPED IN SMOKE. ONE OF THE BEAUFIGHTERS IS SEEN ON THE RIGHT.

PERSONALITIES OF THE WEEK: PEOPLE IN THE PUBLIC EYE.

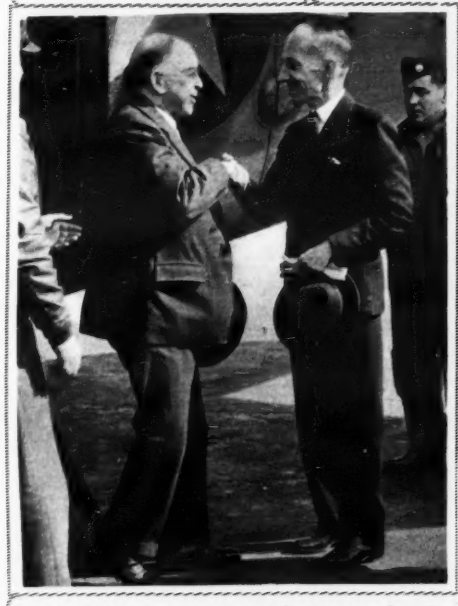
MR. F. ERNEST JACKSON, A.R.A.
One of the four recently elected A.R.A.s is Mr. Ernest Jackson, painter. His three pictures in this year's Royal Academy are "The Choir Boy," "The Reverend Abbot Nicholas Gibbs," and "Mademoiselle Marianne Straube."

MR. WILLIAM DRING, A.R.A.
Mr. William Dring, another of the recently elected A.R.A.s, is also a painter. He studied art at the Slade School; Slade Scholarship, first prizeman in drawing and painting of figure and head, second prizeman for composition. Has exhibited for many years at the Royal Academy.

COLONEL FRANK KNOX.
The Secretary of the U.S. Navy since 1940, Colonel Knox died on April 28 followirg a heart attack. Aged 70. His life was devoted to newspaper management, save for service in 1898 with Roosevelt's Roughriders and as Vice-Presidential candidate on the Republican ticket in 1936.

FRANCIS DRAKE.
The Stanhope Gold Medal, the highest award of the Royal Humane Society, has been awarded for 1943 to Francis Drake, of Johannesburg, aged fourteen. He lowered himself into a 40-ft. well to rescue a small child. In the excitement, Drake was forgotten, but managed to crawl out.

THE HON. SIR DEREK KEPPEL.
Sir Derek Keppel, whose active service at Court lasted from 1893 until his retirement in 1936, died on April 26. Appointed Equerry to the Duke of York (later King George V.) in 1893, and since 1936 he had been an Extra Equerry to the present King.

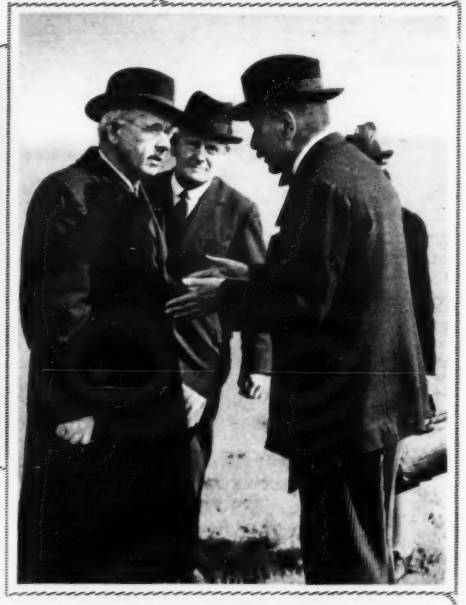


MR. MACKENZIE KING, CANADA'S PREMIER (LEFT), GREETED ON ARRIVAL BY MR. VINCENT MASSEY.

THE AUSTRALIAN PRIME MINISTER: MR. CURTIN ARRIVES IN ENGLAND.

THE PRIME MINISTER OF SOUTH AFRICA: FIELD-MARSHAL SMUTS, NOW IN BRITAIN.

The first wartime conference among the Prime Ministers of the Commonwealth opened in London on May 1, with Mr. Churchill presiding. Beginning as a Council of War, the Prime Ministers will then discuss all problems of reconstruction and security after the victory, and will enter into ways and means of improving inter-Imperial consultation. The chief members are: Mr. Churchill and Lord Cranborne; Mr. Mackenzie King, Canada; Mr. Curtin, Australia; Mr. Fraser, New Zealand; General Smuts, South Africa. Representatives of India and the Prime Minister of S. Rhodesia will also take part.



MR. PETER FRASER, NEW ZEALAND PREMIER (LEFT), GREETED BY MAJOR SPENCER CHURCHILL.

THE ALLIED SUPREME COMMAND IN CONFERENCE: SERVICE CHIEFS WHO ARE RESPONSIBLE FOR THE COMING LIBERATION OF EUROPE PHOTOGRAPHED AT THEIR HEADQUARTERS

The Allied Supreme Command, as shown above, is composed of the following seven Service chiefs: (l. to r., seated) Air Chief-Marshal Sir Arthur Tedder, Deputy Supreme Commander; General Dwight D. Eisenhower, Supreme Commander; General Sir Bernard Montgomery, Commander-in-Chief, British Group of Armies; (l. to r., standing) Lt.-Gen. Omar N. Bradley, Sr. Commander, U.S. Ground Forces; Adm. Sir B. Ramsay, Allied Naval Com.; Air Chief-Marshal Sir T. Leigh Mallory, Air C.-in-C.; and Lt.-Gen. Walter Bedell Smith, Chief of Staff.

AN IMPORTANT NEW NATIONAL GALLERY ACQUISITION NOW ON VIEW: A VERY BEAUTIFUL PICTURE BY NICCOLO DELL' ABBATE (1512-1571) ILLUSTRATING THE "GEORGICS." CANVAS, 74¼ IN. BY 94¼ IN.

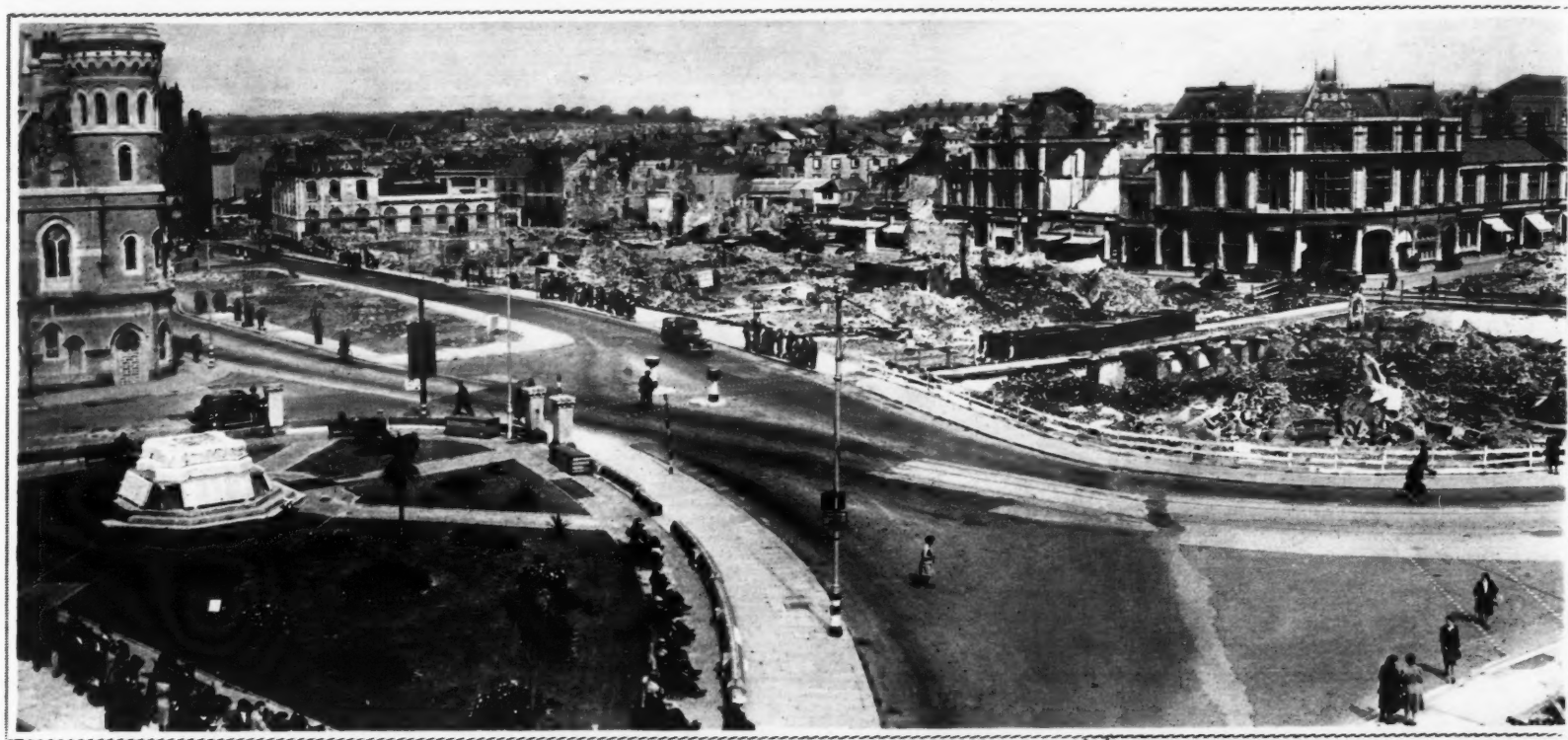
NOW on view at the National Gallery is an important picture by Niccolo dell' Abbate purchased from the Castle Margam Collection in 1942 and presented to the National Gallery by the National Art Collections Fund. It is one of that artist's most important canvases, measuring 74¼ in. by 94¼ in. and is in a perfect state of preservation. The subject is taken from that part of the fourth book of the "Georgics" in which Virgil describes the story of Eurydice and the Serpent:

". . . She never saw,
Poor girl, her death there, deep in the grass before her feet—
The watcher on the river-bank, the savage watersnake.
The band of wood-nymphs, her companions, filled with their crying
The hilltops: wailed the peaks of Rhodope: high Pangæa,
The unwarlike land of Rhesus,
The Getæ lamented, and Hebrus, and Attic Orithyia."

(From the new translation by C. Day Lewis of the Georgics of Virgil. Jonathan Cape.) Niccolo dell' Abbate was born in Modena in 1512, and was one of the leading North Italian mannerists. Some time before 1552 he went to France and, with Primaticcio, was one of the Italian painters who created the Fontainebleau School. He died in 1571. The new acquisition shows the fanciful elegance which characterised the decorations at Fontainebleau, and also contains a magnificent mannerist landscape of the type made familiar by Tintoretto and his circle.

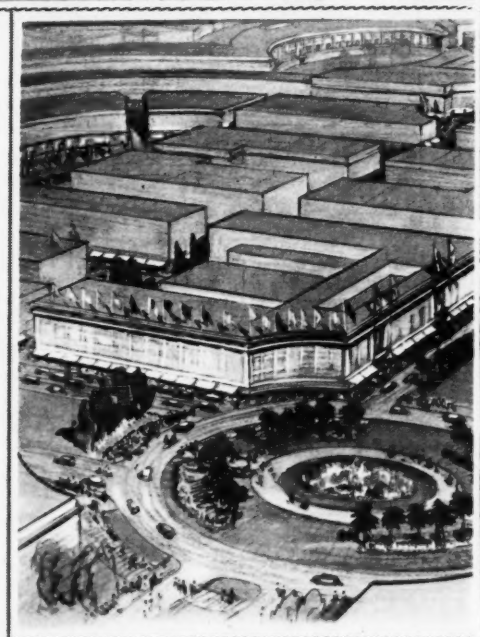
THE NATIONAL GALLERY PICTURE OF THE MONTH: "THE PAINTER'S DAUGHTERS"; BY GAINSBOROUGH (1727-1788). CANVAS, 45 IN. HIGH BY 41 IN. WIDE. *c.* 1757-58.

CALLED by Gainsborough "Molly and the Captain," this painting shows the artist's two daughters advancing hand-in-hand under the trees. Margaret Gainsborough, the younger, on the left, stretches out her hand to catch a butterfly. She is wearing a white bodice and a light-green skirt. Mary (afterwards Mrs. Fisher; right) is in light yellow. Thomas Gainsborough, stated by some critics to occupy the highest place in the English school, whether as a portrait painter or a landscape painter, was born at Sudbury in 1727 and became one of the thirty-six original members of the Royal Academy on its foundation in 1768. By 1779 Gainsborough was at the very height of his fame; all the eminent men of the day sat to him, and he was the favourite painter of the King and Royal Family. From 1769 to 1783 (excepting in the years 1773 to 1776), he was a constant contributor of portraits and landscapes to the exhibitions of the Royal Academy; but in the year 1783, owing to a disagreement over the hanging of one of his pictures, he withdrew them all and never again contributed. He died in 1788. As a colourist Gainsborough ranks with Rubens, and in technical work Ruskin says that "Turner is a child to him." His life-work consists of upwards of 300 paintings, of which over 220 were portraits.



PLYMOUTH TO-DAY: A BOMB-DEVASTATED AREA AT AND AROUND SPOONERS CORNER. PLYMOUTH WAS ONE OF BRITAIN'S MOST HEAVILY BLITZED CITIES DURING THE BAD RAIDS OF 1941.

AN ARTIST'S SKETCH OF THE PROPOSED TRAFFIC CENTRE AT THE MAIN RAILWAY STATION. PART OF A PLAN FOR THE RECONSTRUCTION OF PLYMOUTH AFTER THE WAR.



AN ARTIST'S SKETCH OF THE PROPOSED SHOPPING RISING GROUND, AND THROUGH THE AREA WILL

A PLAN for the reconstruction of Plymouth has been produced and made public in the form of a report prepared for the city council by Mr. J. Paton Watson, city engineer and surveyor, and Professor Patrick Abercrombie, F.R.I.B.A., consultant. "A Plan for Plymouth" (Underhill [Plymouth], Ltd.; 10s. 6d.) is a volume liberally illustrated with pictures and diagrams and with a Foreword by Mr. Winant, U.S. Ambassador, and an Introduction by Lord Astor, the Lord Mayor of Plymouth. The authors have planned a city which will be a dockyard, a naval and military centre, a shopping centre for a wide area, a holiday and tourist centre, a port for sea and air, an industrial town, a residential town, a centre of farming of various types, and a fishing town. They base themselves on three chief principles: that the new city must be more healthy, convenient and beautiful than the old; that the historic Plymouth of the Age of the Seadogs must be preserved; and that the huddle of houses in narrow streets and lanes which characterised the hurried expansion of the nineteenth century must go, and that wide traffic thoroughfares, convenient precincts and many more open spaces must take their

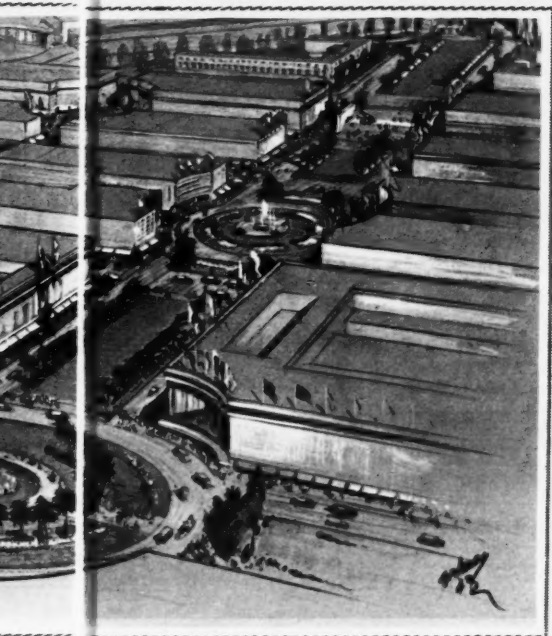
[Continued above, opposite.

THE HEART OF PLYMOUTH: ACROSS THE CENTRE OF THIS DISTRICT RAN GEORGE STREET, ONCE

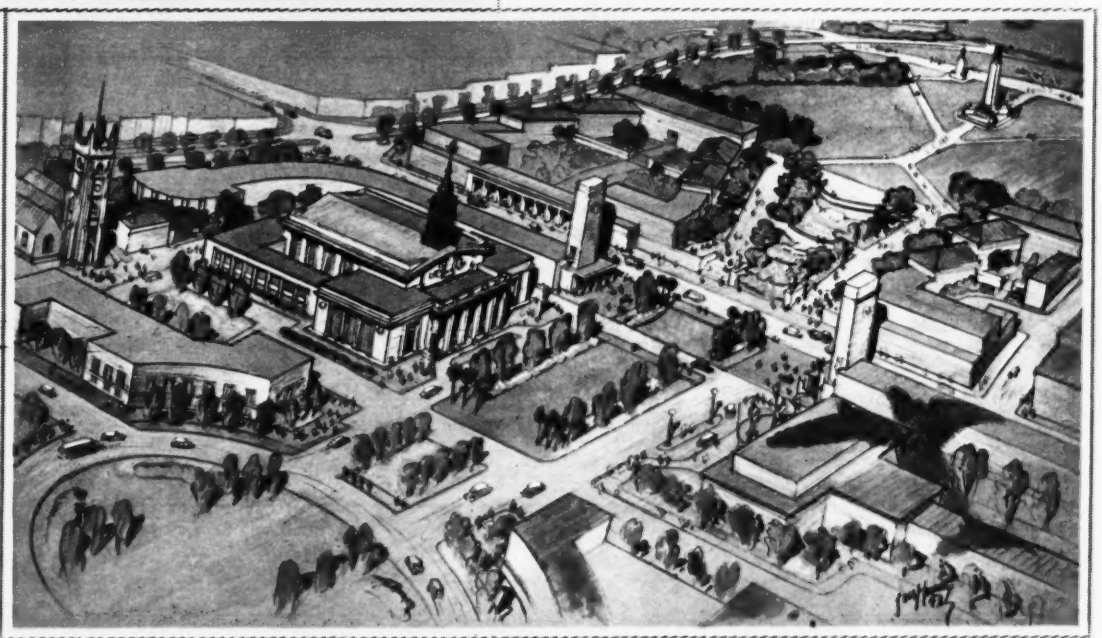
A PLAN FOR PLYMOUTH WHICH SAFEGUARDS ITS LINKS WITH THE GLORIOUS PAST AND PREPARES FOR A SPLENDID FUTURE.

Continued.

place. Practically all the city centre, including civic buildings, shopping streets, and many residential quarters, was razed to the ground by the bombing raids of 1941, and the western part of the city, at Devonport, which had a centre of its own, is in an equally tragic state. The supreme virtue of the plan will be its opening up of the renowned Hoe. In the new Plymouth, from a remodelled North Road Station will run a vista to the Naval War Memorial on the Hoe, "a garden vista, a park way, making use, with terraces, slopes, steps, pools, avenues, and other contrasting features, of the varying levels. . . ." The town centre through which this vista will run is to be composed of several precincts apportioned, from south to north, to hotels and boarding-houses, banks, the Civic Centre—standing close to a restored St. Andrew's Church—a theatre centre, an extensive shopping quarter, Government and professional offices, and, on the north-east corner, the cultural Precinct. Communications are carefully designed—a ring road for through trunk traffic, which need not enter the city, with a high-level bridge over the Tamar at Saltash—and ample main routes for city traffic. The plan aims at safeguarding the city's precious links with the glorious past and preparing with confidence for an equally splendid future.



CENTRE, PLYMOUTH. THIS CENTRE LIES ON RUN THE SINGLE PURELY DECORATIVE FEATURE.



A BIRD'S-EYE VIEW OF THE PROPOSED CIVIC CENTRE: FROM AN ARTIST'S SKETCH. THE CIVIC PRECINCT BEGINS ON THE PLANE OF ST. ANDREW'S CHURCH, NOW A MERE SHELL.

A BUSY SHOPPING STREET. THE TWO TOWERS IN THE CENTRE ARE (LEFT) THAT OF ST. ANDREW'S CHURCH; AND (RIGHT) THAT OF THE GUILDHALL.

THE WORLD OF SCIENCE.

CANADA'S METALS AND THE WAR.

By E. S. GREW.

TO Canada, as to all the world, the war has changed the values of the metals that are part of her contribution to ending it. Embedded in the shield of pre-Cambrian rocks covering her surface from east to west are gold and silver and platinum; copper, nickel, cobalt, and asbestos; uranium, radium, and lead. Ten years ago gold had a foremost place in the treasury of the future, and its seekers and prospectors were hastening from Quebec and Ontario to the Canadian North-West, where, under the shadow of the Rockies, another Klondike was to be sought, and where, on the Great Slave Lake, Yellow Knife had become a typical gold-mining town. It is so still, but its output is falling.

Following the example of the United States, which shut down its gold-mines because man-power and machinery were wanted for more essential ores, Canada has also put its gold on the retired list for the time being. It is low in the priority lists for the wherewithal to maintain its position. The production of precious metals fell in value from close on 206 million dollars in 1941 to 140½ million dollars last year. In the same period, the value of the mined base metals rose from 135½ million dollars to nearly 196 million dollars. Molybdenum, mercury, chromium, tungsten, were climbing up the ladder. A gold-mine preserved its standing if tungsten also could be got out of it. Even asbestos, in which Canada tops the world's production, became of more use than gold.

In this category of redistributed values, radium kept undisturbed its commanding place. The story of its discovery and working is interwoven with that of the gold of the North-West. The tale began before America asserted its independence by heaving British tea-chests into Boston Harbour while John Hearne was finding copper at Coppermine River, in the Arctic, and was continued when Alexander Mackenzie, exploring the Mackenzie River, saw coal-seams afire on its banks in the year of the French Revolution. He noted also a high, steep rock of variegated red, green and yellow hues, from which the Eskimo were stripping flakes.

Thereafter nothing disturbed the solitudes for two centuries, when prospectors, following the Mackenzie River as a route to reach the Klondike in 1897, staked some forgotten gold claims on their way. Three years later James Mackenzie, a geologist, and Charles Cammel, a fur trader, perilously exploring the 12,000 square miles of Great Bear Lake in a small cutter, came upon the same kind of rocks, variegated red, black, pink, and white, that Mackenzie had seen. They were reflected in the deep, still waters of Echo Bay, on the lake's eastern side. This is where, but not till 1930, Gilbert la Bine, a Canadian mining engineer, flying a 'plane over the Great Bear region, led the way to support the rifling of one of the two richest pitch-blende mines in the world. The other is at Jadotsville, in the Belgian Congo, which just before the war had produced half of the 26 ounces of radium then refined from all the world's sources of the metal, some others of which are elsewhere in Canada.

A mill was built for crushing and concentrating the rocks containing uranium and its content of radium at the El Dorado, though its resources proved insufficient. With radium, as with other treasures sought on the Tom Tiddler's ground of gold, silver, and copper about the Great Bear and the Great Slave Lakes, the major hindrance has been that of transport. Not so long ago ore was carried on 50-ton barges towed up the swift, shallow Bear River, through eight miles of rapids bisecting it. The railroad to Hudson Bay, long talked of, was unbuilt. Oil, another prize, was to have been carried by pipe-line, but the cost was too heavy for the Canadian subsidiary of Standard Oil, and only a short section existed. The aeroplane has come to the help of radium, and refined gold cannot do without it. The rock containing radium can be flown to railhead and then taken to Port Hope, in Ontario, for refining.

The Port Hope refinery is a very different place from that Paris laboratory—"half tumbledown stable, half potato-cellar," as Professor Wilhelm Ostwald described it—where Pierre and Madame Curie first saw the glow of radium. It is an establishment with vast departments filled with the equipment for grinding the pitch-blende, or carnotile ore, for mixing it with chemicals, for refining and for crystallising; but the process of the Curies is unaltered. When we reflect that for the extraction of 1000 lbs. of radium chloride which may produce a single gramme of radium, 500 tons of ore have to be treated with 300 tons of chemicals, with the provision of 1000 tons of coal and 1000 tons of distilled water, we have some measure of the labours of the Curies.

The uranium-radium matrix, having been first ground to a suitable fineness, is leached with acid or alkali. Barium is added, and the solution of barium and what there is of radium is precipitated together, so as to simplify the recovery of radium from it. The liquid is converted into a mingled solution of barium chloride and radium chloride. These must be separated, and because the radium chloride crystallises the more quickly, the crystals are recovered as soon as formed. Such action is repeated over and over again, till at last all the radium chloride is recovered at one end of the liquid, leaving the barium chloride at the other. There is yet another and a final fractional crystallisation, which is followed by the conversion of the chloride into first a carbonate and then into radium bromide. Pure radium bromide is thus obtained by a lengthy and complicated chemical process, with which no other can be compared in its extremely fine concentration.

Radium is itself a pure white metal seldom seen and never used, because on exposure to air it reacts with moisture and decomposes at once into radium hydroxide. It has to be converted into radium salts, radium bromide, or radium sulphate to ensure its integrity. A substance so minute and so difficult and lengthy to prepare must needs be costly, and calls for as much guardianship and as much care in its distribution and preservation as in its extraction. One gramme, which is 1000 milligrammes, is about 15½ grains, and 28½ grammes is 1 ounce avoirdupois. The standard quantity of radium, such as is deposited at Brussels, Paris, the National Physical Laboratory, and the Radium Institute in London, is kept in sealed tubes containing 21·99 milligrammes of this precious metal. One last stage of its preservation must be mentioned. From the refinery it is distributed to the laboratories, where it is inserted into a variety of tubes, needles, and plaques for therapeutic employment, into which we need not follow it.

It has occupied an unequal, if not an unjustified, amount of our space in its description; but more than any other production of the Canadian North-West it emphasises the metallic wealth which there awaits only an expansion of transportation such as the post-war 'plane may bring.

COBALT ISLAND: LABINE POINT, ON GREAT BEAR LAKE, NORTH-WEST TERRITORIES, CANADA.

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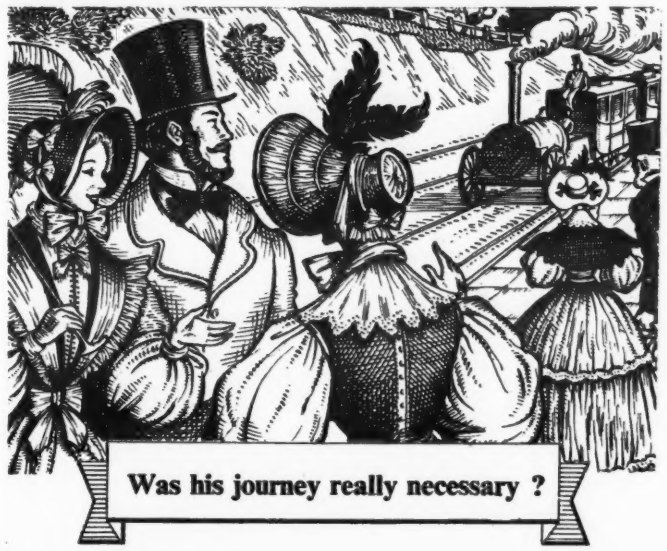

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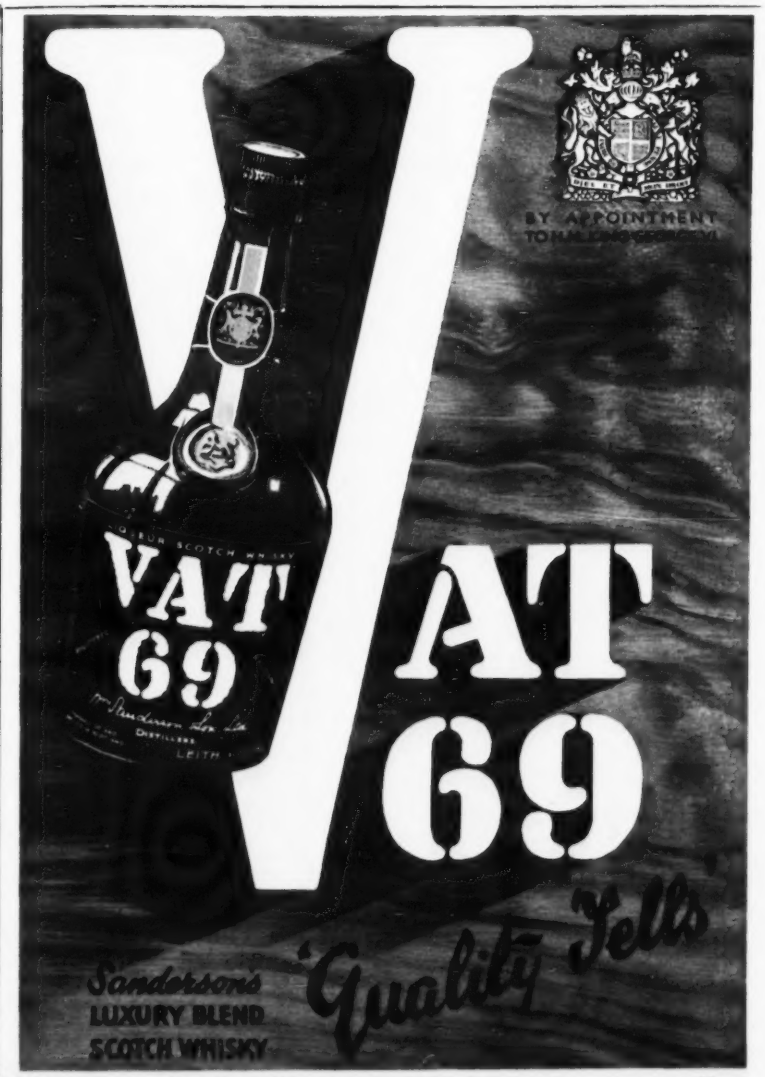

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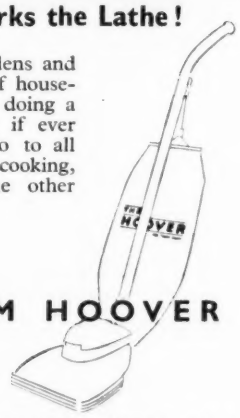

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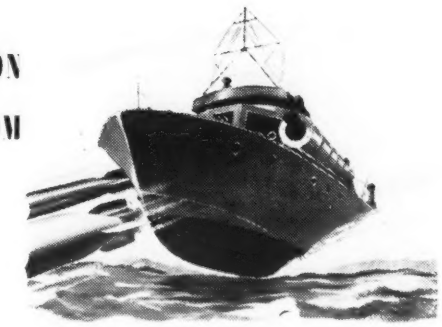

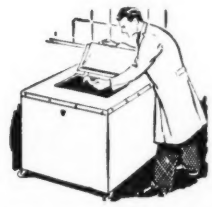

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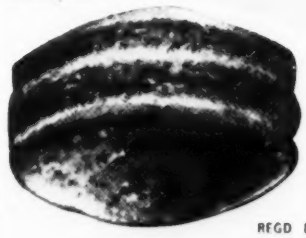

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